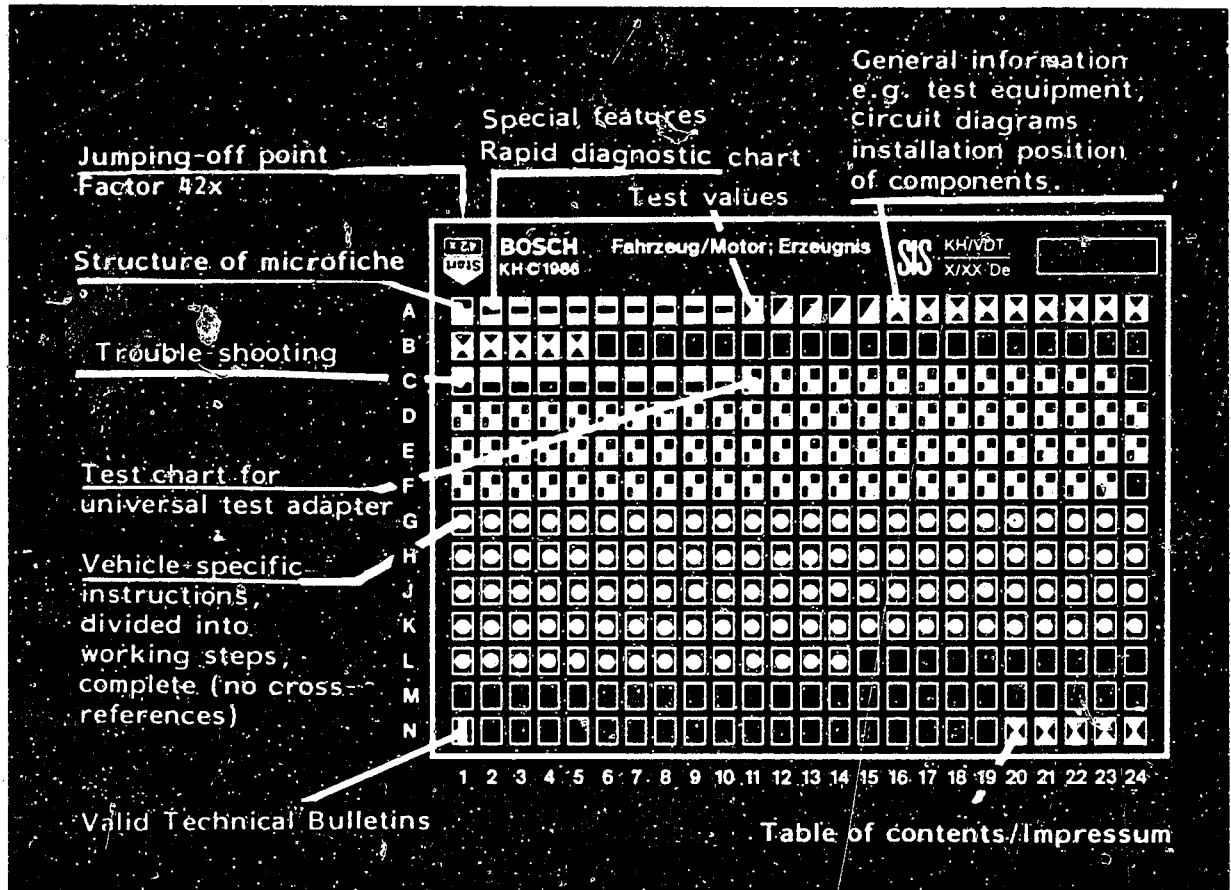


## Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

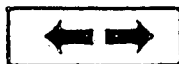
<b>E16</b>	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



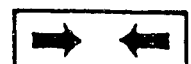
Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

**C6**

**A1**

Trouble-shooting program



This microcard contains the trouble-shooting instructions for the Motronic in the following VOLVO models valid at the time of printing:

- VOLVO 740 Turbo with 2.3l/4-cyl. engine
- VOLVO 760 Turbo (8.1984 →)  
Europe version

### SPECIAL FEATURES

- The idle speed is regulated by an electronic controller and actuator from BOSCH (no auxiliary-air device).
- The solenoid-operated injection valves are operated by an external amplifier (injection output stage) with 4 outputs (1 output per valve). This is energized from the Motronic control unit (term. 14).
- The electronic traction control (ETC - a non-Bosch product) is an independent system (control unit) which prevents wheel slip by reducing the engine torque. This is done by slip-dependent throttling of the fuel supply to the engine by temporarily shutting down injection valves via the injection output stage (in steps by suppressing individual injection signals)

### 1. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the Motronic expert to quickly check the electrical part of the system with the universal test adapter.











The rapid diagnosis chart contains the following information:

- Switch positions on the universal test adapter
- Sequence of test steps
- Notes on how to operate the universal test adapter or other components
- Readings on the multimeter and motortester
- References to coordinates of the respective detailed testing and trouble-shooting program.

If detailed instructions and information are required, always proceed in accordance with the trouble-shooting charts starting on Coordinate C1.



# Rapid diagnosis chart for universal test adapter

<u>Test step</u>	<u>Switch position</u>		<u>Remarks</u>	<u>Test specifications (reading)</u>	<u>For trouble-shooting see Co-ordinate</u>
	V	$\Omega$			
1		1	Shift gear to neutral, ignition off. Disconnect control unit and relay set. Measure insulation resistance of engine-speed sensor. Term 8 against term. 5	<u>Greater than 1M<math>\Omega</math></u>	C 18
2		2	Measure insulation resistance of reference-mark sensor. Term. 25 against term. 5	<u>Greater than 1M<math>\Omega</math></u>	C 20
3		3	Measure winding resistance of engine-speed sensor. Term. 8 against term. 27	<u>0.6 ... 1.6 k<math>\Omega</math></u>	C 22
4		4	Measure winding resistance of reference-mark sensor. Term. 25 against term. 26	<u>0.6 ... 1.6 k<math>\Omega</math></u>	D 3
5		5	Measure resistance of engine temperature sensor (NTC II). Term. 13 against term. 5	At + 15°C to + 30°C: <u>1.45 ... 3.3 k<math>\Omega</math></u> (depends on temperature)	D 7
6		6	Measure resistance of air temperature sensor (NTC I). Term 22 against term. 5	At + 15°C to + 30°C: <u>1.45 ... 3.3 k<math>\Omega</math></u> (depends on temperature)	D 9
7/8		7/8	Deleted	-----	-----
9		9	Measure resistance of double temperature sensor (NTC II - coolant). Term. 13 to term. 5	<u>Less than 10 <math>\Omega</math></u>	D 11
10		10	Deleted	-----	-----
11		11	Measure resistance. Ground term. 16 against term. 5	<u>Less than 10 <math>\Omega</math></u>	D 15
12		12	Deleted	-----	-----

**A3**

Rapid diagnosis chart  
Volvo 740/760 Turbo

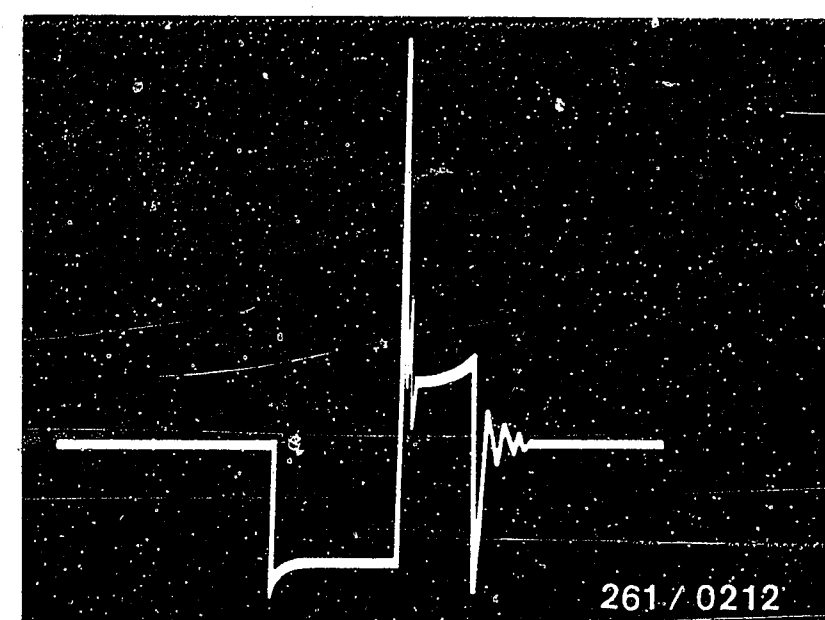
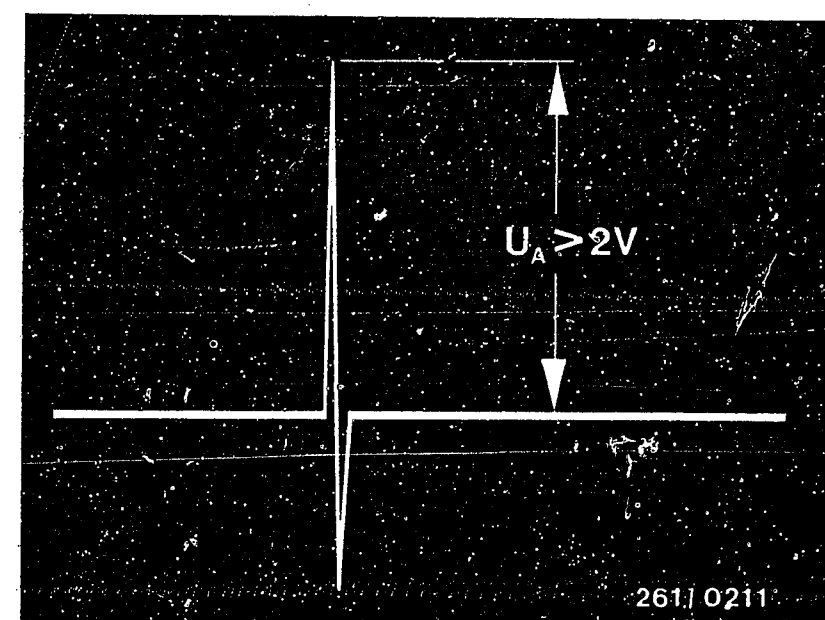
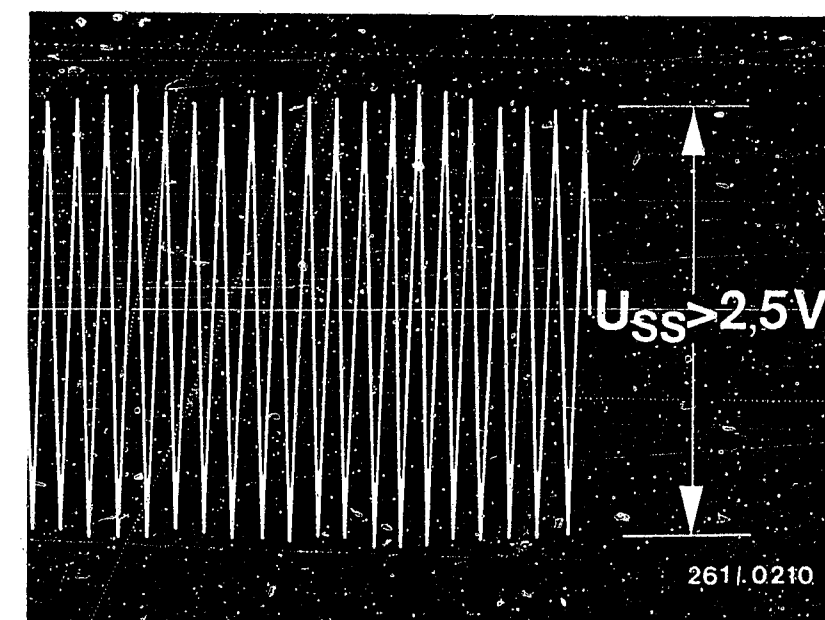

**A4**

Rapid diagnosis chart  
Volvo 740/760 Turbo



# Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position		Remarks	Test specifications (reading)	For trouble-shooting see Coordinates
	V	$\Omega$			
13	↓	13	Measure resistance. Ground term. 19 to term. 5	less than 10 $\Omega$	D 17
14	↓	14	Measure resistance of charge-air temperature sensor. Term. 30 to term. 5.	at +15°C to 30°C: 0.9...1.1k $\Omega$ (temperature-dependent)	D 19
15	↓	15	Not applicable	----	----
16	1	15	Check signal with oscilloscope. Engine-speed sensor term. 8 to term. 27. Shift gear to neutral and start.	See top diagram	D 21
17	2	15	Check signal with oscilloscope. Reference-mark sensor term. 25 to term. 26. (Positive spike first). Shift gear to neutral and start.	See center diagram	E 1
18/19	3/4	15	Not applicable	----	----
20	6	15	Ignition off. Connect control unit and relay set. Ignition on. Measure power supply to control unit, term. 35 to term. 5.	10...15 V	E 7
21	7	15	Measure power supply term. 18 to term. 5.	10...15 V	E 9
22	5	15	Check ignition signal with oscilloscope. Shift gear to neutral and start. Control unit, ignition stage term. 1 to term. 5. Evaluation: signal present.	see bottom diagram	E 11



**A5**

Rapid diagnosis chart  
Volvo 740/760 Turbo



**A6**

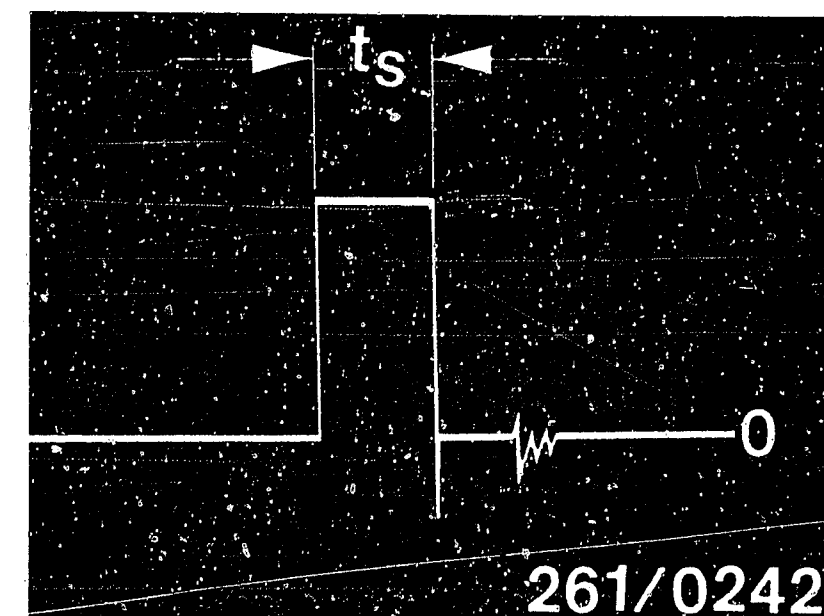
Rapid diagnosis chart  
Volvo 740/760 Turbo



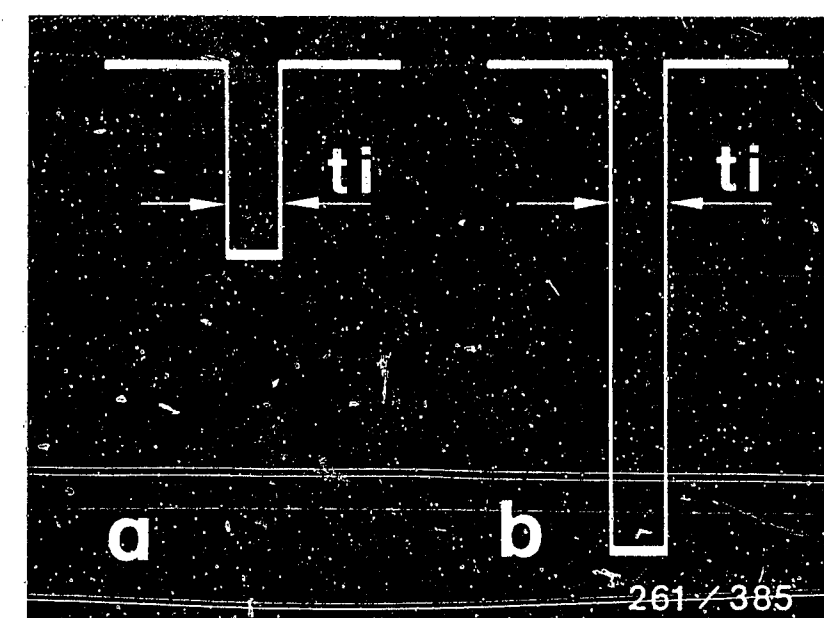


# Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position	But-ton	Remarks	Test specifications (reading)	For trouble-shooting see Coordinates
	V	$\Omega$			
23	8	15	Measure voltage at control unit. Term. 9 to term. 5	greater than 7 V	E 13
24	9	15	Measure voltage at air-flow sensor. Term. 7 to term. 5 Sensor flap in rest position: Sensor flap fully open:	100...250 mV greater than 7 V	E 15
25/ 26	10/11	15	Not applicable	----	----
27	12	15	Measure voltage. Starting signal (term. 50) term. 4 to term. 5	8...15 V	E 17
28	13	15	Check dwell-period signal from control unit with oscilloscope. Term. 21 to term. 5. Shift gear to neutral and start.	See top diagram	E 19
29	14	15	Check injection signal from control unit with oscilloscope. Term. 14 to term. 5. (Energization of injection output stage). Shift gear to neutral and start.	See bottom diagram (a)	E 21
30	14	15	T1 As 29, but duration of injection becomes slightly longer after pressing button (NTC II cold).		E 23
31	15	15	Not applicable	----	----
32	16	15	Check injection signal $t_i$ from control unit with oscilloscope (measuring output). Term. 11 to term. 5. Shift gear to neutral and start.	See bottom diagram (b)	F 1



$t_i$  = Duration of injection



**A7**

Rapid diagnosis chart  
Volvo 740/760 Turbo



**A8**

Rapid diagnosis chart  
Volvo 740/760 Turbo



# Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch position</u>		<u>But-ton</u>	<u>Remarks</u>	<u>Test specifications (reading)</u>	<u>For trouble-shooting see coordinates</u>
	V	$\Omega$				
33	17	15		Measure voltage at pump relay term. 20 to term. 5. Ignition on.	<u>10 ... 15 V</u>	F 3
34	17	15		Measure voltage. Shift gear to neutral and start. Control unit, pump control, active. Term. 20 to term. 5	<u>max. 4 V</u>	F 5
35	17	15	T3	Ignition off. Connect pressure gauge. Ignition on. Press button T3. Read off fuel pressure.	<u>2.8 ... 3.2 bar</u>	F 7
36	17	15		Connect motortester. Connect CO analyzer. Let engine run. Switch off air conditioner (if fitted). Check idle speed and CO. Note: If idle speed differs greatly from specification or if engine hunts at idle. Basic setting of idle-speed control	<u>900 min<sup>-1</sup></u> <u>0.5 ... 2.0 %CO</u>  <u>Setting value</u> <u>1.0 %CO</u>	F 13
	17	15	T2	As above, values unchanged!		
37	17	15		Let engine run. Check spark advance at idle speed. Important: idle speed must be 900 min <sup>-1</sup> , otherwise other spark-advance angles will be indicated. Switch off air conditioner (if fitted).	<u>5° ... 15°</u>	F 17
38	17	15		Dwell angle at idle speed	<u>8° ... 15°</u>	F 19
				Dwell angle at 3000 min <sup>-1</sup>	<u>30° ... 45°</u>	
39	17	15	T5	Keep engine speed constant at 2000 min <sup>-1</sup> . Press button T5. Injection signals stop and, if engine at operating temperature, start again at approx. 1000 min <sup>-1</sup> .	<u>Engine "hunts"</u>	F 21

**A9**

Rapid diagnosis chart  
Volvo 740/760 Turbo



**A10**

Rapid diagnosis chart  
Volvo 740/760 Turbo



## 2. TEST SPECIFICATIONS

Ignition timing at idle:    10° crankshaft

Idle speed:                      900 min<sup>-1</sup>

**J5**

Exhaust-gas setting  
CO checking value with  
engine at op. temp.:            0.5 ... 2.0 vol.%CO  
CO setting value:                1.0 vol. %CO

Fuel pressure:                      2.8 ... 3.2 bar

**F7**

Fuel-pump delivery:            min. 850 cm<sup>3</sup>/30s

**K19**

Pre-supply pump:                min. approx. 935 cm<sup>3</sup>/30s

Solenoid-operated injection valve

Electrical internal  
resistance:                      2 Ω ... 3 Ω

**G3**

Series resistor for  
injection valve                      5 Ω ... 7 Ω

Air-flow sensor

Resistance between  
term. 7 and term. 6:            8 Ω ... 2500 Ω  
(Deflect sensor flap)

**G21**

term. 9 and term. 6:            500 Ω ... 1100 Ω

Idle actuator

Electrical internal resis- Term. 3/4: 19...25 Ω  
tance (at +15°...+30°C) : Term. 5/4: 17...22.5 Ω

**A13**

Charge-air  
temperature sensor

**D19**

Electrical internal  
resistance

at + 15°C...+30°C:            900 Ω ... 1100 Ω  
at +80°C:                        1230 Ω ... 1370 Ω

**A11**

Test specifications

Volvo 740/760 Turbo



Temperature sensor I (NTC I air):

Electrical internal resistance

at +15°C...+30°C: 1.45...3.3 k $\Omega$

measured at air-flow

sensor between term. 22

and term. 6 at +80°C: 280...360  $\Omega$

**D9**

Temperature sensor II (NTC II coolant):

Double NTC for Motronic and idle-speed control

Electrical internal resistance of each temperature sensor:

At ambient temperature (+15°C...+30°C): 1.45...3.3 k $\Omega$

With engine at op. temp.

(approx. +80°C): 280...360  $\Omega$

**D7**

Throttle-valve switch

Resistance of idle contact

(term. 2 and ground): 0  $\Omega$

**D11**

Start valve

Electrical internal resistance

approx. 4  $\Omega$

**G13**

Engine-speed sensor and reference-mark sensor

Electrical internal resistance:

0.6...1.6 k $\Omega$

**C22**

Thermo-  
time  
switch

35°C/7.5 s

Electrical internal resistance

"G" and  
ground

"W" and  
ground

"G"  
and "W"

Ambient  
temp.  
(below  
+30°C):  
Op. temp.  
(above  
+40°C):

25...40  $\Omega$

0  $\Omega$

25 ... 40  $\Omega$

...80  $\Omega$

100...160  $\Omega$

50...80 $\Omega$

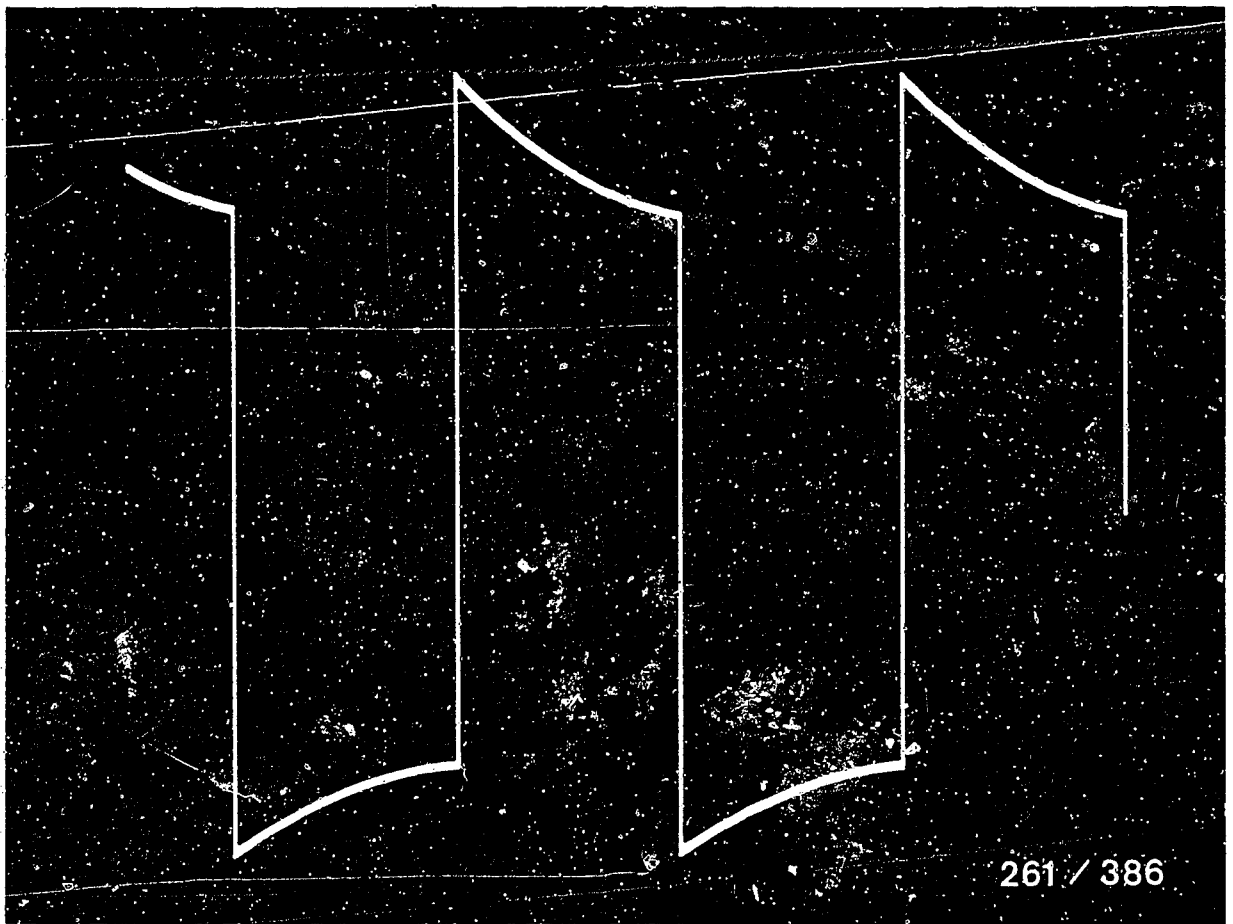
**G19**

**A12**

Test specifications

Volvo 740/760 Turbo





### Signal at idle actuator

#### Testing the idle-speed control

- Push back protective rubber cap on plug to actuator and, using test prods with plug connected, check the voltage at term. 3 and 5 to term. 4 with oscilloscope (see diagram).  
If no pulses, check leads to idle controller (terminals 3, 4, 5).
- Record on/off ratio at idle actuator at  $900 \text{ min}^{-1}$  with dwell-angle tester, term. 3/4: 67...77%, term. 5/4: 23...33 % (engine at operating temperature, switch off electrical devices).
- Measure winding resistance of actuator (at  $+15^{\circ}\text{C} \dots +30^{\circ}\text{C}$ ), term. 3/4: 19...25  $\Omega$ ; term. 5/4: 17...22.5  $\Omega$  (to do this, disconnect plug).
- Further trouble-shooting: actuator mechanically defective e.g. rotary slider stiff.



## Checking and basic setting of idle-speed control (continued)

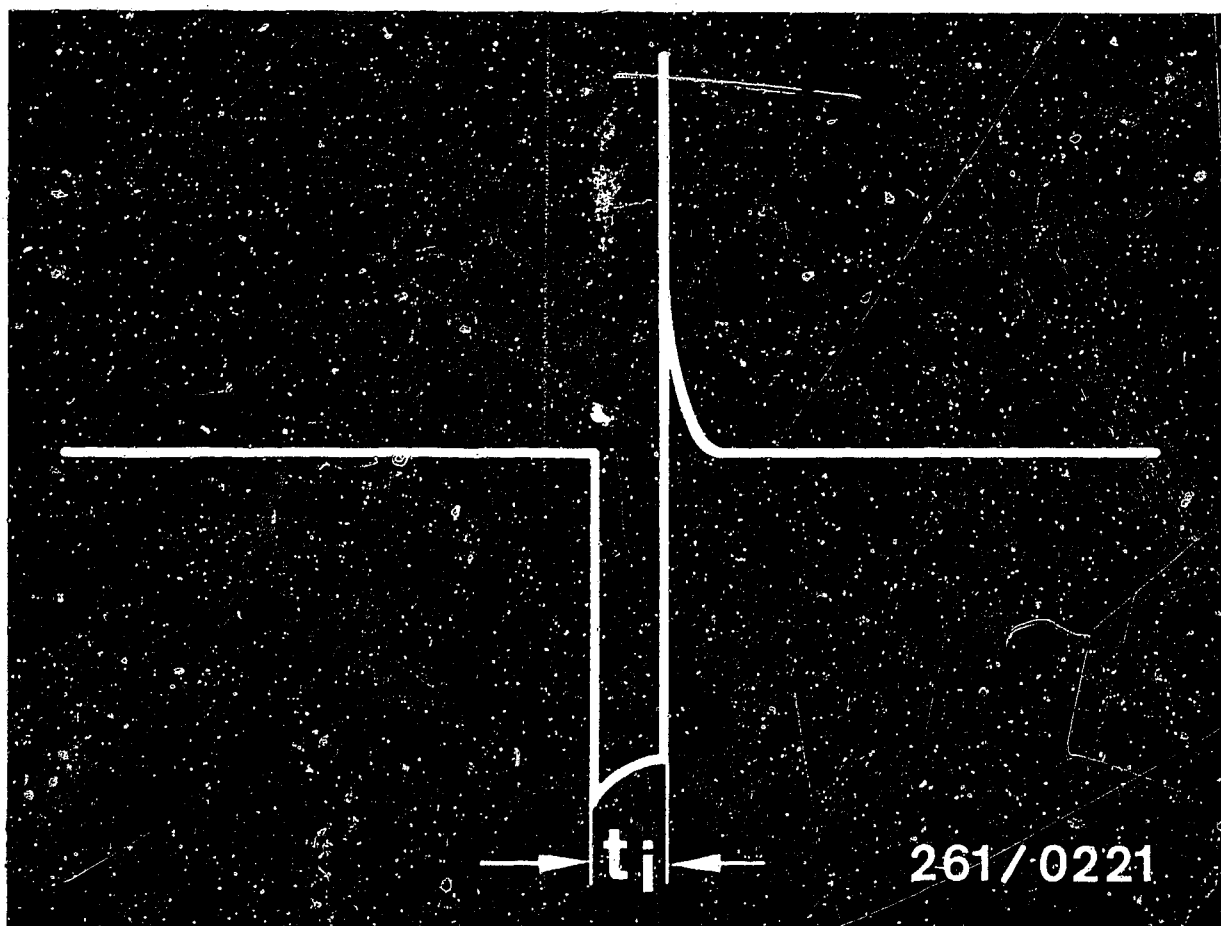
### Idle controller O.K.?

- Dwell-period signal present at term. 12 of controller? Measure with controller connected, directly at back on plug (engine idling)
- Check power supply (10...15 V) at term. 1/2. Switch on ignition.
- Idle contact closing with throttle valve closed?  
– Is there then approx. 0 V at term. 8?
- Check double temperature sensor (NTC II).  
Switch off ignition and disconnect plug to controller. Measure resistance between term. 9 in plug and vehicle ground.
- At +15°C...+30°C: 1.45...3.3 k $\Omega$  (engine cold)  
+80°C: 280...360  $\Omega$  (engine at op. temp.)
- With air conditioner off, there must be no battery voltage at term. 7.

### Basic setting of idle speed

- Run engine at idle at normal operating temperature, switch off all electrical devices and connect test output of idle controller (on wiring harness near air-flow sensor) to vehicle ground.
- Set engine speed to 800 ... 850 min<sup>-1</sup> at idle-speed-adjusting screw.
- Checking value for on/off ratio 20...30 % (idle, actuator: term. 5/4). Then disconnect test output from ground.





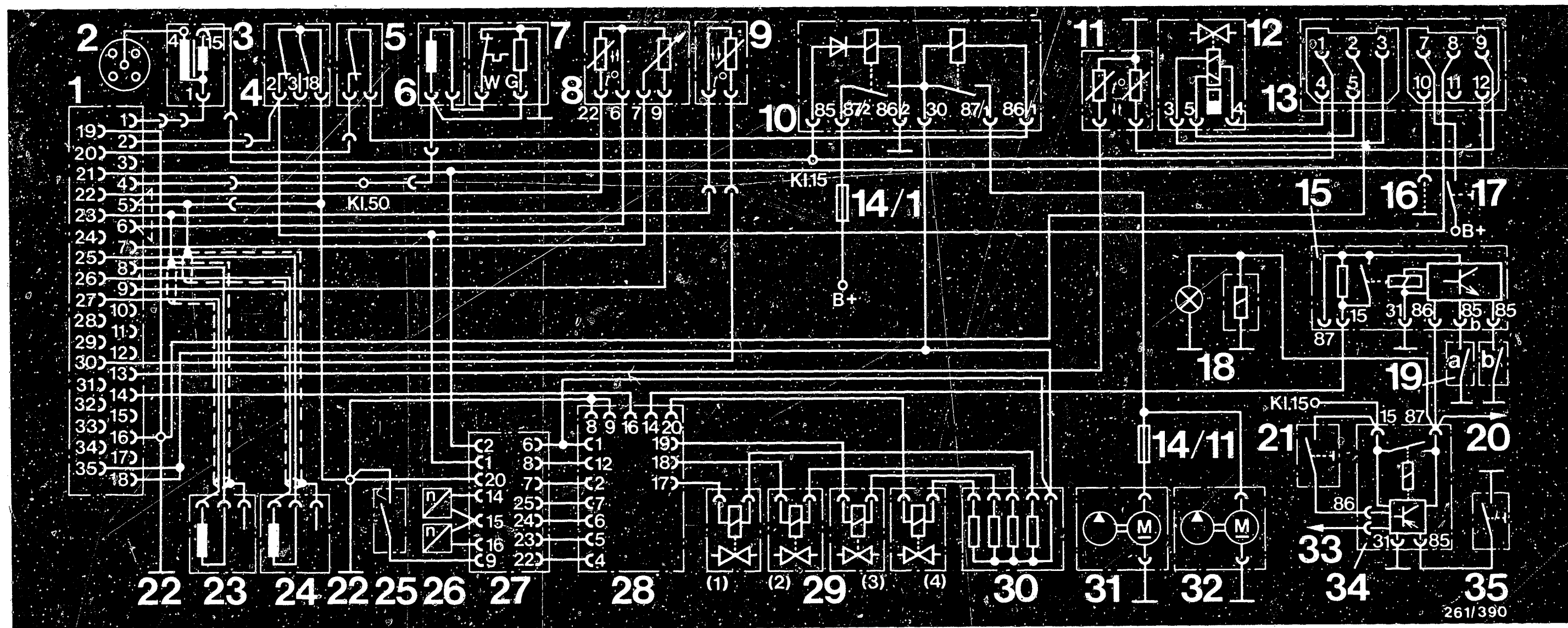
Injection signal at injection valve.

$t_i$  = Duration of injection

#### Checking the external injection output stage

- Start engine and check injection pulses at injection valves with oscilloscope (use test lead 1 684 463 093).
- With ignition off, disconnect 25-pin plug to output stage and check the power supply (ignition on: 10...15 V at term. 1/8).
- Check connection between term. 16 and Motronic term. 14 with ohmmeter (approx. 0  $\Omega$ ).
- Switch off ignition. Disconnect the ETC control unit and check ignition pulses again with oscilloscope. If the injection output stage functions only with the ETC control unit disconnected, this points to a fault in the ETC system.





### 3. ELECTRICAL TERMINAL DIAGRAM

1 = Plug to control unit  
 2 = High-voltage distributor  
 3 = Ignition coil  
 4 = Throttle-valve switch  
 5 = Charge-air pressure relief switch  
 (pressure monitor)  
 6 = Start valve  
 7 = Thermo-time switch  
 8 = Air-flow sensor with air-temperature  
 sensor (NTC I)

9 = Charge-air temperature sensor  
 10 = Relay set (main relay and pump relay)  
 11 = Double temperature sensor (NTC II)  
 12 = Idle actuator  
 13 = Idle controller  
 14 = Fuses No. 1 and No. 11  
 16 = Test output  
 17 = Switch on air conditioner  
 22 = Ground terminal on fuel-  
 distribution pipe

25 = On/off switch for ETC  
 26 = Engine-speed sensor for ETC (rear  
 wheels)  
 27 = ETC control unit  
 28 = Injection output stage  
 29 = (1,2,3,4) injection valves  
 30 = Series resistors for injection  
 valves

**A16**

Electrical terminal diagram  
Volvo 740/760 Turbo

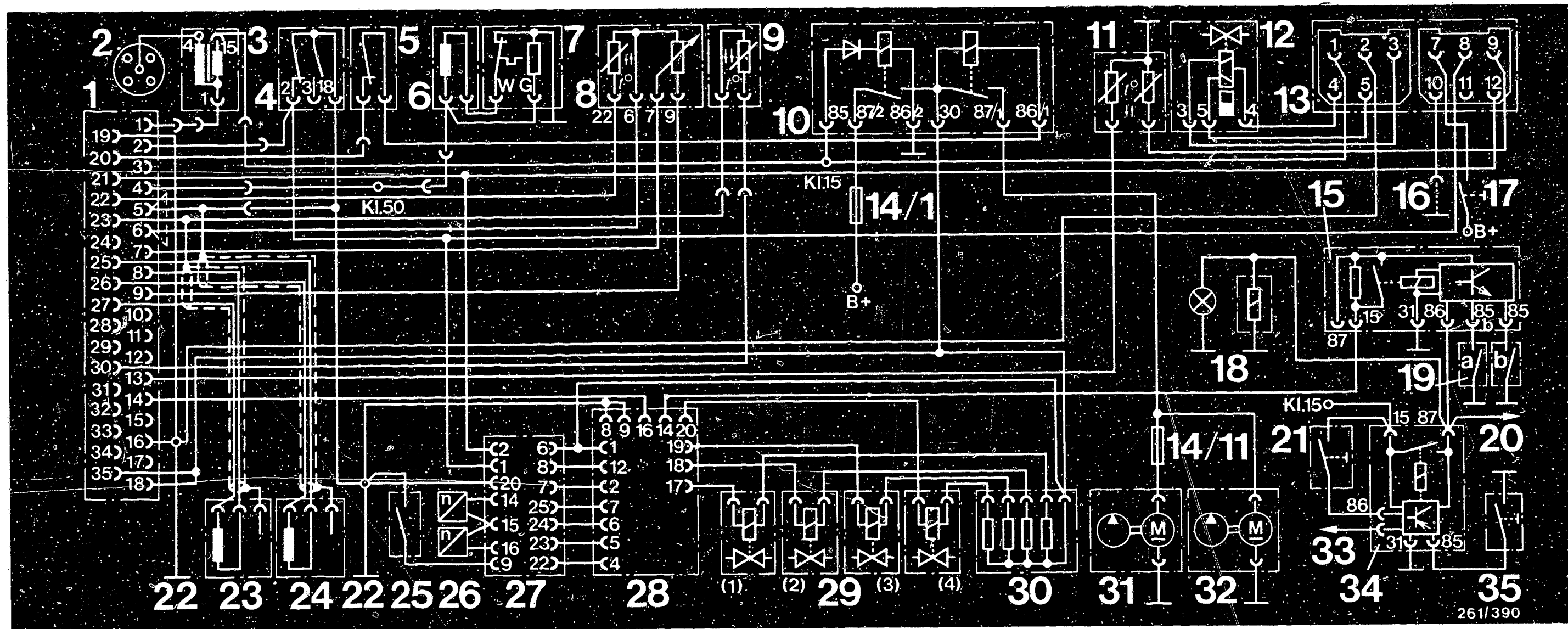


**A17**

Electrical terminal diagram  
Volvo 740/760 Turbo







# Electrical terminal diagram (continued)

- |   |                              |                                 |
|---|------------------------------|---------------------------------|
| 15 = Time-delay relay   | 21 = Actuating switch for OD | 33 = To speedometer             |
| 18 = Indicator lamp and magnetic switch for overdrive (OD)      | 23 = Engine-speed sensor     | 34 = Switching relay for OD     |
| 19 = Charge-air pressure switch (a) and oil-pressure switch (b) | 24 = Reference-mark sensor   | 35 = Transmission switch for OD |
| 20 = To relay for shift indicator                               | 31 = Pre-supply pump         |                                 |
|   | 32 = Electric fuel pump      |                                 |

**A18**

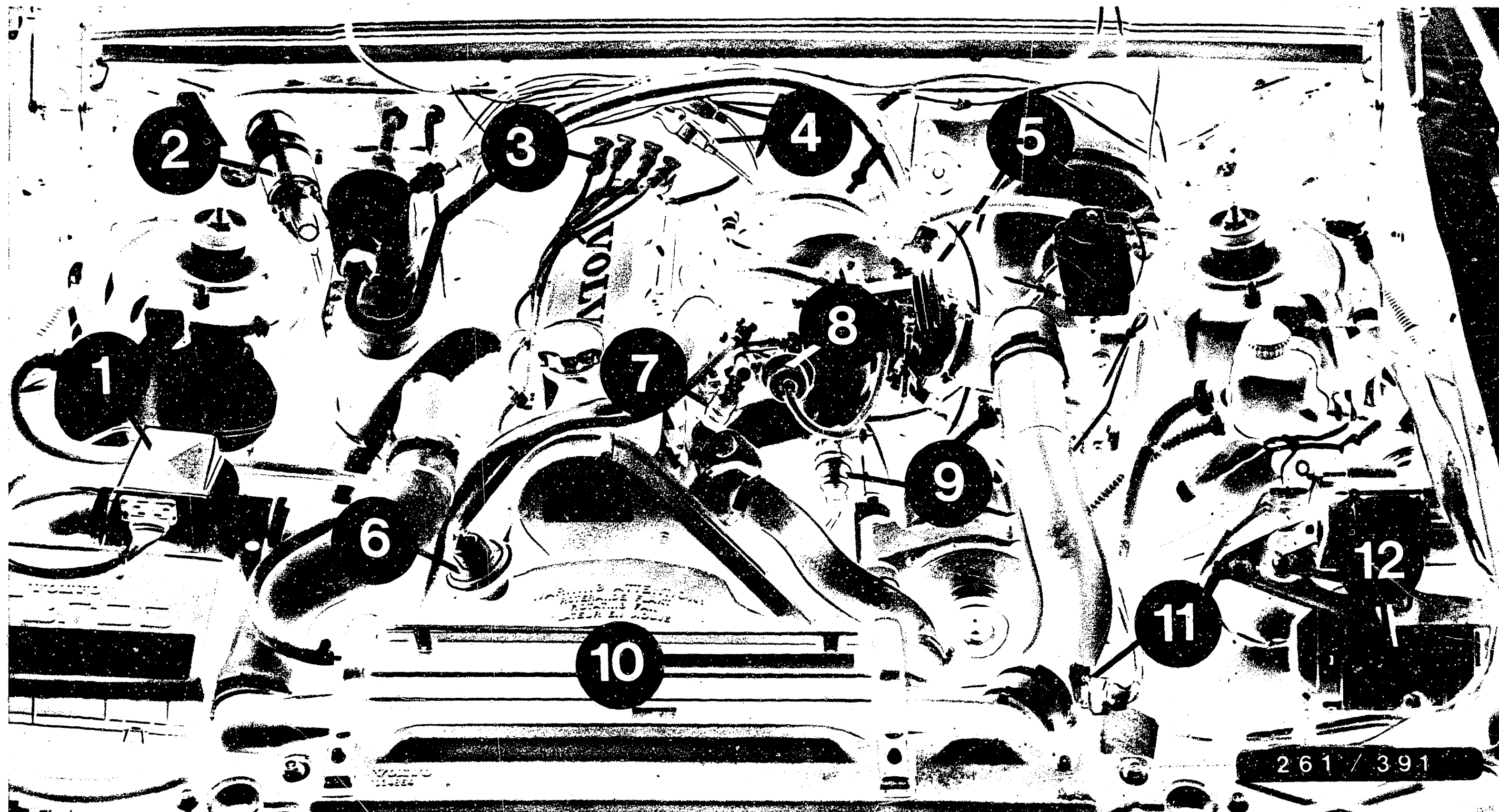
Electrical terminal diagram  
Volvo 740/760 Turbo



**A19**

Electrical terminal diagram  
Volvo 740/760 Turbo





#### 4. INSTALLATION POSITION OF COMPONENTS

- 1 = Air-flow sensor
- 2 = Ignition coil
- 3 = High-voltage distributor
- 4 = Plug connectors for inductive sensors

- 5 = Throttle-valve switch
- 6 = Bypass-air valve
- 7 = Injection valves
- 8 = Pressure regulator

- 9 = Idle actuator
- 10 = Charge-air cooler
- 11 = Charge-air temperature sensor
- 12 = Injection output stage

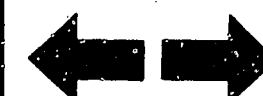
**A20**

Installation position of components  
Volvo 740/760 Turbo



**A21**

Installation position of components  
Volvo 740/760 Turbo



## Installation position of components (continued)

The indications "right" and "left" apply always as viewed in the forward direction of travel. Listed below are the components which are not visible in the picture.

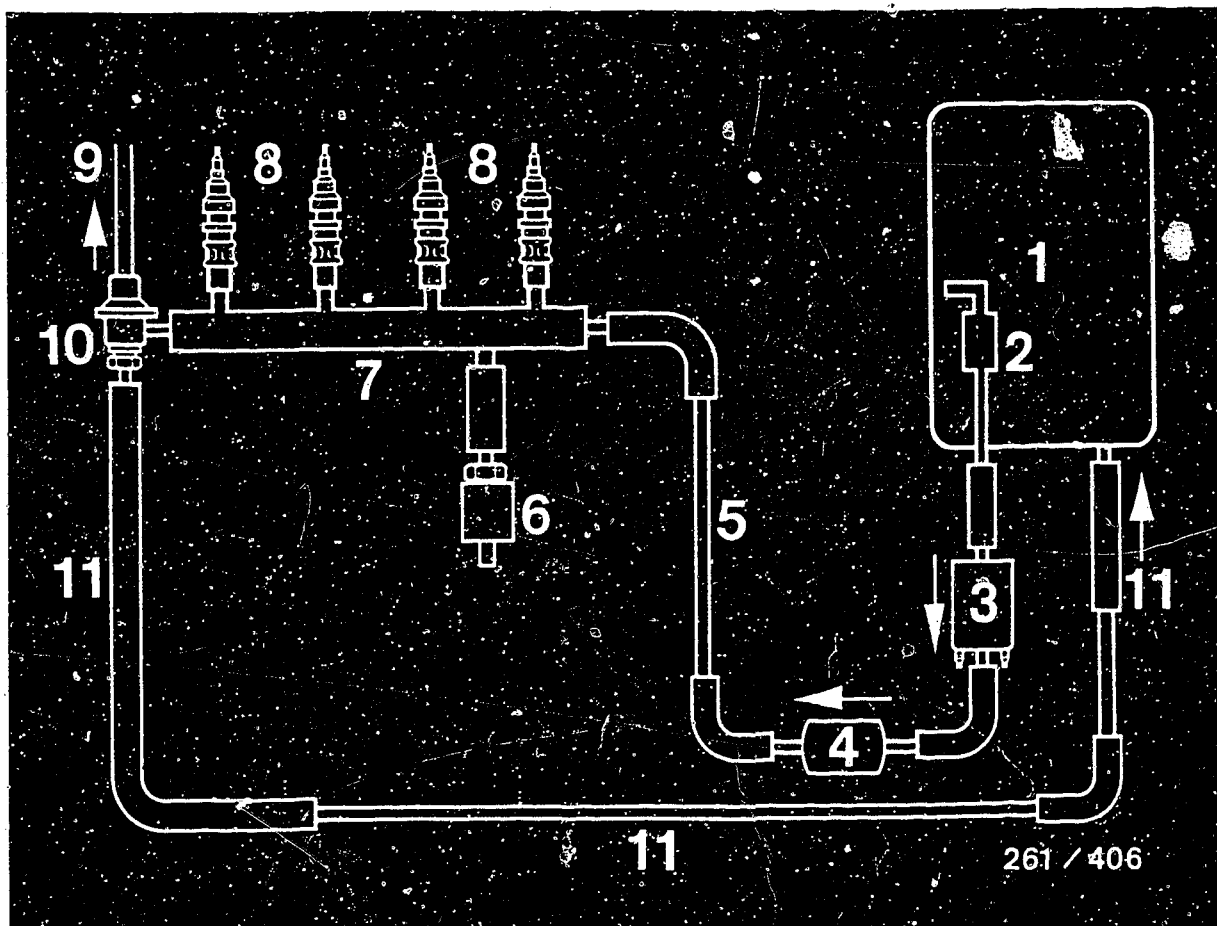
- Reference-mark and engine-speed sensors  
In starting-motor ring gear housing on circumference of flywheel ring gear.
- Fuel filter and fuel pump  
Underneath vehicle (center of vehicle)
- Pre-suppply pump  
In tank
- Control unit  
Behind side panel in right-hand footwell.
- Central ground  
Under front fastening screw of fuel-distribution pipe.
- Relay set and fuse board  
In passenger compartment on center console behind ashtray
- Double engine-temperature sensor (NTC II)  
Underneath intake port of cylinder 3.
- Thermo-time switch 35°C/7.5 s  
Underneath intake port of cylinder 4
- Start valve  
On intake manifold (bottom center)
- Wastegate  
Near exhaust-gas turbine.
- Charge-air pressure relief switch and charge-air pressure switch  
Behind instrument panel, above pedals.



## Installation position of components (continued)

- Idle controller  
In passenger compartment (above engine-hood opener).
- Test output for idle-speed basic setting  
On wiring harness. (Near air-flow sensor).
- Series resistors for solenoid-operated injection valves  
In engine compartment, left-hand inside wall (near injection output stage)
- ETC control unit  
In passenger compartment above pedals.
- Wheel-speed sensors (ETC)  
One each on left and right on rear-axle drive.
- Front-axle wheel-speed sensors (ETC + ABS):  
One each on left and right at the steering knuckles.





## 5. DIAGRAM OF FUEL LINES

- 1 = Fuel tank
- 2 = Fuel pre-supply pump (in tank)
- 3 = Electric fuel pump
- 4 = Fuel filter
- 5 = Fuel delivery line
- 6 = Start valve
- 7 = Fuel-distribution pipe
- 8 = Solenoid-operated injection valve
- 9 = To intake manifold
- 10 = Pressure regulator
- 11 = Fuel return line



6. Test equipment and tools		
<u>Description</u>	<u>Designation</u>	<u>Part No.</u>
Universal test adapter Adapter cable	ETT 018.01	0 684 101 801 1 684 463 124
Motortester	e.g. MOT 002.00 or 200	0 684 000 200
Exhaust-gas analyzer	e.g. ETT 008.04 or ETT 008.05	0 684 100 804 0 684 100 805
Multimeter with (internal resistance min.) 20 k $\Omega$ /V)		Commercially available e.g. type MA 2H from Metrawatt or Chinaglia, Cortina model
Pressure tester or  Pressure tester (no longer avail- able)	Quality class 1.0 0.1 bar divi- sions	KDJE-P 100  KDEP 1034



<u>Description</u>	<u>Part No.</u>
Feeler gauge for measuring the sensor air gap (up to 1 mm)	commercially available
Lubricant for engine-speed and reference-mark sensors	Molykote Longterm 2, commercially available
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Electrical connecting lead (Test lead) for direct connection of components under test e.g. injection valves)	KDJE 7450/70
Test lead 2-pole, for measuring resistances and signals e.g. at injection valves	1 684 463 093
Test leads for proper connection of test equipment at component plugs	KDZS 0004 (2.8 mm wide) KDZS 0005 (6.3 mm wide)

**B2**

Test equipment and tools

Volvo 740/760 Turbo



## 7. Important general information

This information must be observed in order to prevent damage to the engine, control unit or ignition coil and for the safety of personnel.

7.1 Never start engine without securely connected battery.

7.2 Incorrect polarity of the supply voltage, e.g. by incorrect connection of the battery or ignition coil, can lead to irreparable damage to the control unit.

7.3 Do not use a fast charger for starting the engine.

Use only a second 12 V battery and jump leads.

Caution! Owing to different requirements of vehicle manufacturers with regard to electronic products we advise you not to use 24 V batteries as an aid for starting. Follow the vehicle owners manual.

7.4 Disconnect the battery from the vehicle electrical system before fast charging.

7.5 When charging the battery in the vehicle or when using a starting aid, follow the information in the operating instructions of the fast charger and also follow the information given by the vehicle manufacturer.

7.6 Never disconnect the battery from the vehicle electrical system with the engine running.

7.7 Do not short-circuit ignition coil term. 1 to ground (e.g. for stopping the engine). The ignition coil and possibly the control unit will suffer irreparable damage.





7.8 Never bring the positive pole of the battery into contact with ignition coil term. 1. The control unit will suffer irreparable damage.

7.9 Never connect or disconnect the wiring-harness plug of the control unit with the ignition switched on.

7.10 Remove the control unit at temperatures above 80°C (paint-drying installation).

7.11 Remove the control unit before performing welding work (electric spot welding).

7.12 Remove the relay combination when performing a compression test. This prevents undesired injecting of the injection valves.

7.13 If installing an alarm system, follow the installation instructions for Motronic vehicles or microfiche ALL-500.

It must be ensured that the alarm relay does not suffer interference from stray fields (e.g. from H.T. ignition cables), causing it to trip incorrectly.



CAUTION!High-energy ignition  
system.Dangerous primary and  
secondary voltages.

The above sticker has the following meaning:

The Motronic contains a high-performance ignition system which can be dangerous if live parts or terminals are touched (both on the primary as well as secondary sides).

In this connection we should like to point out that the relevant legal regulations concerning work on electrical installations must be observed when testing or working on the ignition system.

The ignition must always be switched off when working on the ignition coil (switch off ignition/voltage source). Such work includes:

- Connection of engine testers (timing light, dwell-tach tester, ignition oscilloscope etc).
- Replacement of parts of the ignition system (spark plug, ignition coil, ignition distributor, ignition cable etc).

If, when testing the ignition system or when performing adjustments on the engine (e.g. carburetor), it is necessary to switch on the ignition (switch on ignition/voltage source), the above-mentioned dangerous voltages occur over the entire system.

There is, therefore, danger of accident not only on the individual components of the ignition system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e.g. tachometer connection, diagnostic plug), on plug-in connections and on testers.



## 8. Trouble-shooting charts

The following trouble-shooting programs are designed to enable the workshop employees using the Universal test adapter and other suitable testers to quickly detect causes of trouble on the Motronic.

Depending on the level of training and experience of the mechanic a choice can be made between the following procedures:

- Detailed, step-by-step trouble-shooting for employees with little experience or practice on Motronic vehicles.
- Pin-pointed direct trouble-shooting for trained and experienced employees who have a great deal of practice on Motronic vehicles.

**C3****C5**

Both trouble-shooting programs start by checking the electrical/electronic part of the Motronic using the Motronic test adapter ETT 018.01. This makes it possible within a short space of time to check the electrical operation of the wiring harness with the connected components (including control unit) and to quickly locate faults.

If no fault is found using the Motronic test adapter, it is necessary to continue with the detailed or the direct trouble-shooting program.

**C1**

Trouble-shooting chart  
Volvo 740/760 Turbo

**C2**

Trouble-shooting chart  
Volvo 740/760 Turbo



## 8. Detailed, step-by-step trouble-shooting chart

- Test with Motronic test adapter

This test must come at the start of the test program and must be performed from beginning to end (coordinates C11...F23).

- Trouble-shooting according to customer complaints (fault symptoms)

The table below contains possible fault symptoms and the right-hand column gives the first coordinate of the respective detailed trouble-shooting program.

The trouble-shooting program consists of logically ordered test steps for all individual components of the Motronic. If, after completing the trouble-shooting program for an assumed symptom, the fault has not been located or remedied, choose a new fault symptom and work through the respective program.

<u>Customer complaints</u> (fault symptom)	<u>Test with test adapter</u>	<u>Coordinates</u>
1. Engine fails to start or starts only with great difficulty	C 11	G 1
2. Engine starts but then dies	C 11	H 1
3. Uneven engine idle	C 11	H 13
4. Poor throttle take-up	C 11	J 7
5. Engine missing under all operating conditions	C 11	J 17
6. Fuel consumption too high	C 11	K 5
7. No maximum engine power	C 11	K 13
8. CO concentration at idle too high or too low	C 11	L 3

**C3**

Trouble-shooting chart  
Volvo 740/760 Turbo

**C4**

Trouble-shooting chart  
Volvo 740/760 Turbo



## 8. Pin-pointed, direct trouble-shooting chart

### ● Test with Motronic test adapter

The test with the test adapter must come at the start of the test program and must be performed from beginning to end (coordinates C11...F23).

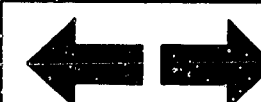
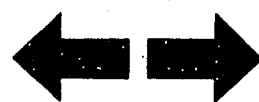
### ● Trouble-shooting according to customer complaints

The table below contains various fault symptoms with several possible causes of the fault in each case. The references given on the left indicate the first coordinate of the test step for the respective individual component of the Motronic. If, after testing the individual components, the fault has not been located or remedied, it is necessary to choose a new fault symptom.

#### Customer complaint (fault symptoms)

1. Engine fails to start or starts only with great difficulty								
2. Engine starts but then dies								
3. Uneven engine idle, idle speed incorrect								
4. Poor throttle take-up								
5. Engine missing under all operating conditions								
6. Fuel consumption too high								
7. No maximum engine power								
8. CO concentration at idle too high or too low								
Cause (component fault)								
C11	C11	C11	C11	C11	C11	C11	C11	Test with universal test adapter
*)								Relay combination (main and pump relay) defective
*)								Electric fuel pump not operating
G11	H5	J3	J13					Idle-speed control defective
G9		H21		K1				Fault in injection output stage
G21	H11	H15	J11	J21	K11	K17	L5	Air-flow sensor defective

Continued on C7/C8/C9/C10



# Customer complaints (fault symptoms)

1. Engine fails to start or starts only with great difficulty							
2. Engine starts but then dies							
3. Uneven engine idle, idle speed incorrect							
4. Poor throttle take-up							
5. Engine missing under all operating conditions							
6. Fuel consumption too high							
7. No maximum engine power							
8. CO concentration at idle too high or too low							
Cause (component fault)							
G21	H3	H17	J11				Air-intake system leaking
G3		H23					Injection valves or (and) series resistors defective
●*)		●*)	●*)		K21		Fuel pressure too low or zero, pressure regulator not operating
		●*)			●*)	●*)	Fuel pressure too high, pressure regulator not operating
				J23	K19		Fuel delivery too low
	●*)				●*)	●*)	Temperature sensor I (air) or temperature sensor II (coolant) defective
					K15		Throttle valve not opening fully
				J19			Poor central ground, loose contacts, faulty plug-in connections
	H3	H17	J11		L1		Open circuit in wiring harness and plug-in connections
		●*)			●*)		Throttle-valve switch defective
		J5					CO exhaust-gas setting too rich, idle adjustment
		J5	●*)				CO exhaust-gas setting too lean, idle adjustment
G13							Start valve not opening
	H7	H19			K9	L7	Start valve not closing

C7

Trouble-shooting chart

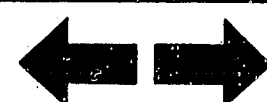
Volvo 740/760 Turbo



C8

Trouble-shooting chart

Volvo 740/760 Turbo



# Customer complaints (fault symptoms)

1. Engine fails to start or starts only with great difficulty

2. Engine starts but then dies

3. Uneven engine idle, idle speed incorrect

4. Poor throttle take-up

5. Engine missing under all operating conditions

6. Fuel consumption too high

7. No maximum engine power

8. CO concentration at idle too high or too low

Cause (component fault)

G19	H9	H19						Thermo-time switch defective
						●*)		Charge-air temperature sensor defective
						K23		Turbocharger or wastegate defective
●*)						K17		Charge-air pressure switch defective
						K17		Bypass air valve defective
G9		H21		K1				Time-delay relay for overdrive defective
●*)								Engine-speed sensor defective
●*)								Reference-mark sensor defective
				K3				Check alternator, interference-suppression devices
G3		H15	J9	J19	K7	K15	L5	Check secondary patterns
●*)	●*)	●*)	●*)	J23	●*)	●*)	●*)	Control unit defective

●\*) This component has already been tested if you have performed the test with the universal test adapter. Continue testing with the next component in this column.  
However, if you have reached this point by way of a component complaint or the test-specification table, you must test this component with the universal test adapter. The test program for the test adapter starts on Coordinate C 11 and must be performed from beginning to end.

**C9**

Trouble-shooting chart

Volvo 740/760 Turbo



**C10**

Trouble-shooting chart

Volvo 740/760 Turbo



## 9. Test with Universal test adapter ETT 018.01

(0 684 101 801) and adapter cable for Motronic

Connect the Motronic test adapter to the Motronic wiring harness (ignition must be off).

For testing the wiring harness and the connected components, only the Motronic wiring harness must be connected - but not the control unit. Be sure to observe the instructions in the test chart!

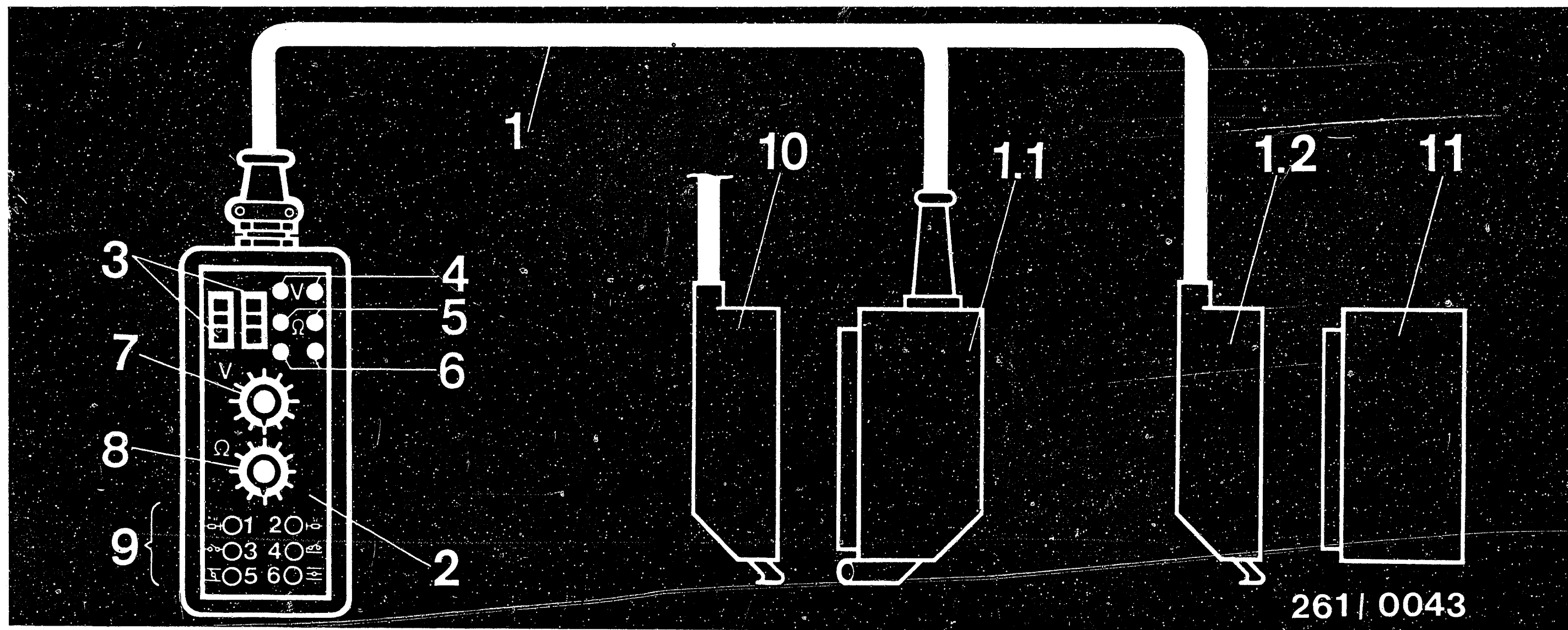
A pointer instrument for the voltage and resistance measurements (multimeter) as well as the motortester must be connected to the test adapter in order to make the measurements.

The individual test steps are selected with the program selector switch. The symbols V and  $\Omega$  show the operator whether voltage or resistance is being measured. Some switch positions are necessary for simulation of operating conditions with engine running. By pressing the pushbuttons it is possible, with the control unit connected and the engine running, to simulate given operating conditions. Thus, for example, with the engine at normal operating temperature it is possible by pressing the push-button T1 to make the control unit "think" that the engine temperature is -20°C. It is then possible to evaluate the reaction of the control unit on the motor-tester.

If necessary, the circuit diagram can be used for trouble-shooting.







# Universal test adapter with adapter lead for Motronic

- 1 = Adapter lead
- 1.1 = Connection to wiring harness
- 1.2 = Connection to control unit
- 2 = Universal adapter (Part No.: 0 684 101 801)
- 3 = Test wells (for motortester)
- 4 = Test sockets (for voltage measurement)
- 5 = Test sockets (for resistance measurement)
- 6 = Test sockets (not occupied)
- 7 = Program switch "V"
- 8 = Program switch "Ω"

- 9 = Button panel for simulation of operating conditions
- 10 = Motronic wiring harness
- 11 = Control unit
- Button 1 = NTC II (engine), cold (-20°C)
- Button 2 = NTC II (engine), warm (+80°C)
- Button 3 = Pump energization
- Button 4 = Not occupied
- Button 5 = Throttle-valve idle contact
- Button 6 = Throttle-valve full-load contact

**C12**

Test with universal test adapter

Volvo 740/760 Turbo

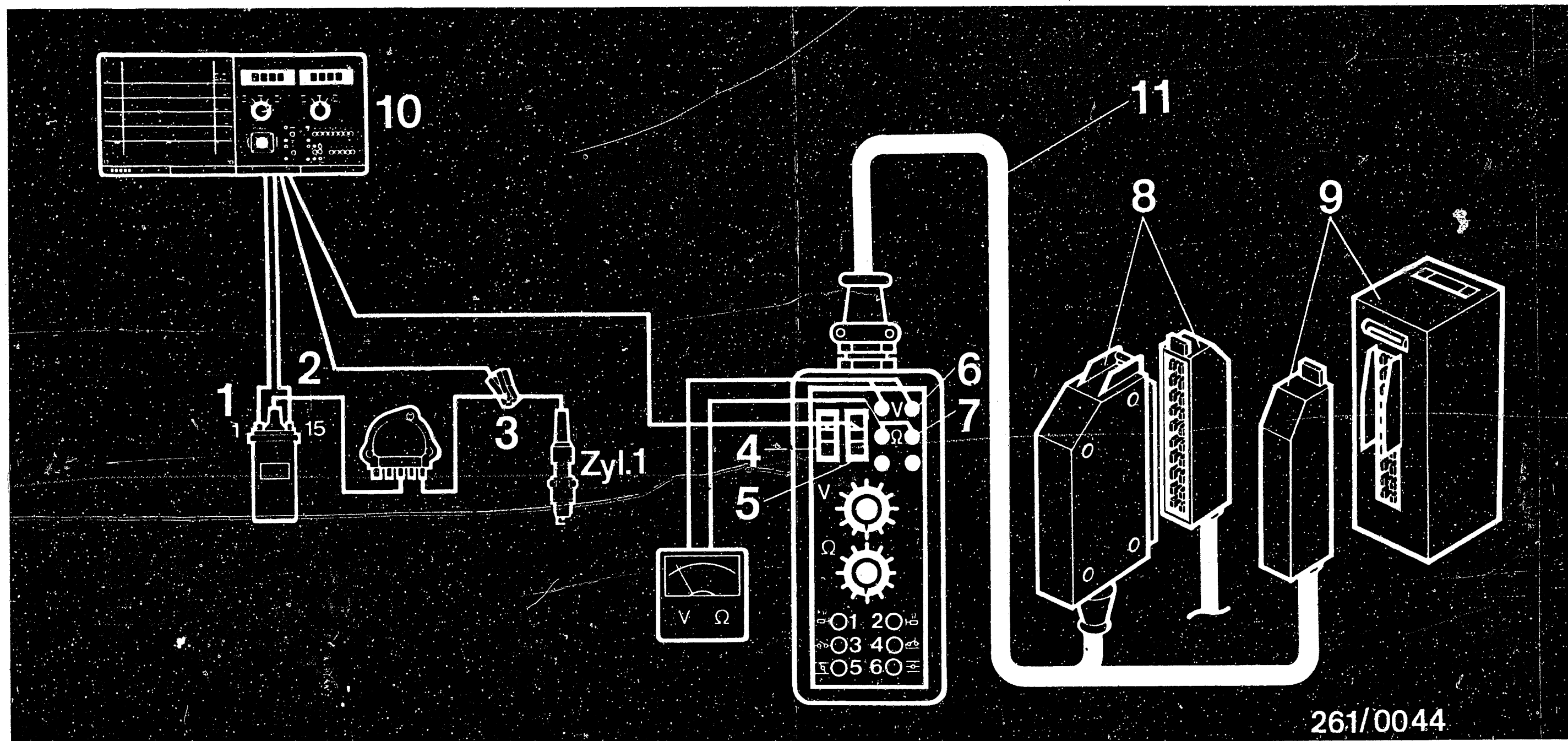


**C13**

Test with universal test adapter

Volvo 740/760 Turbo





261/0044

### 9.3 Connection diagram for test adapter

- 1 = Green clip to ignition coil term. 1
- 2 = Yellow clip to ignition coil term. 15
- 3 = Induction-type clamp-on pickup over H.T. ignition cable of cylinder 1
- 4 = Red connection socket (test well) for red terminal of motortester
- 5 = Black connection socket (test well) for black terminal of motor tester

- 6 = Connection of voltmeter to V sockets (red = +, black = ground or negative)
- 7 = Connection of ohmmeter to black  $\Omega$  sockets (blue)
- 8 = Connection to Motronic wiring harness
- 9 = Connection to Motronic control unit
- 10 = Motortester
- 11 = Adapter cable for Motronic

**C14**

Test with universal test adapter  
Volvo 740/760 Turbo



**C15**

Test with universal test adapter  
Volvo 740/760 Turbo



## Preparations for test with Universal test adapter

### Remove the control unit and connect test test adapter

Installation position of control unit: Behind side panelling in right-hand footwell.

Installation position of the control unit: Under the instrument panelling in front of the steering column.

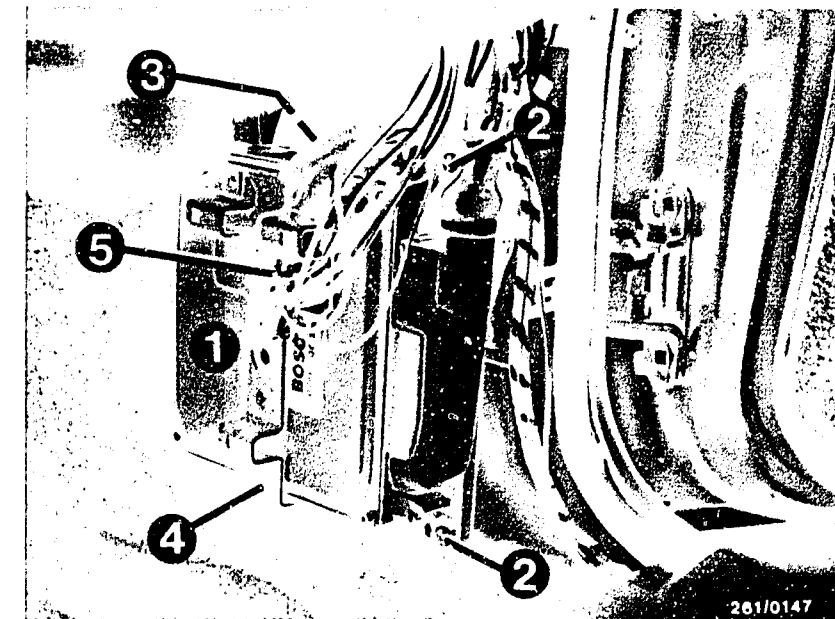
The control unit is fastened by 2 screws and is slipped into the bracket.

### Note

In order to rule out any confusion between the control units of the various systems, a mechanical locking device has been introduced. The "locating lug" (pivot point when opening and connecting the control unit) and the corresponding mounting point on the control unit have matching recesses and pins.

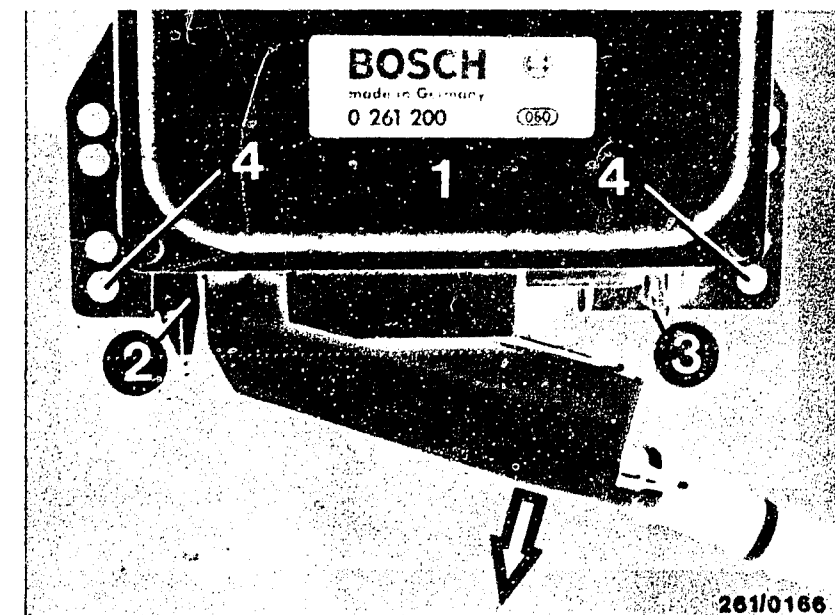
### Note:

In the following test steps, the column "operation" has a white border to show which operation has to be changed compared with the previous operation.



- 1 = Control unit
- 2 = Fastening screws
- 3 = Reed relay for air conditioner
- 4 = Bracket
- 5 = Ground terminals

- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Fastening holes



**C16**


Test with universal test adapter  
Volvo 740/760 Turbo

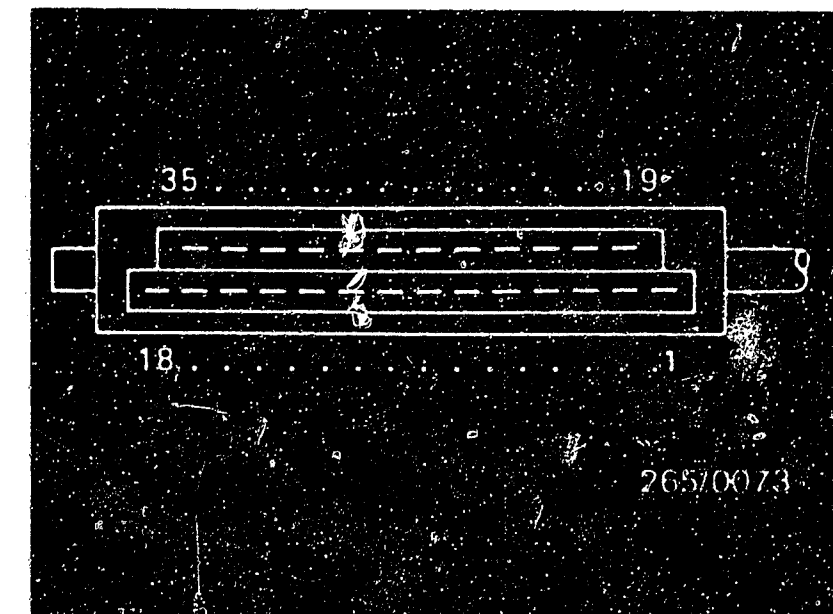


**C17**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 1: Switch off ignition. Disconnect control unit and pump relay		
Operation	Reading	Testing
Program switch position "V"	<div>  </div> Multimeter must indicate  <u>greater than 1M<math>\Omega</math>.</u>	Component:  Engine-speed sensor
Program switch position "Ω"		
Measuring equipment: Multimeter ( $\Omega$ range)		Operation:  Insulation between Term. 8 and ground
Measuring range: 10 M $\Omega$		
Connection: Test sockets	<div> <math>\Omega</math> </div>	Malfunction:  Resistance less than 1 M $\Omega$
Operation in vehicle: Switch off ignition.		
	If reading O.K., <u>continue testing with next test step</u>	



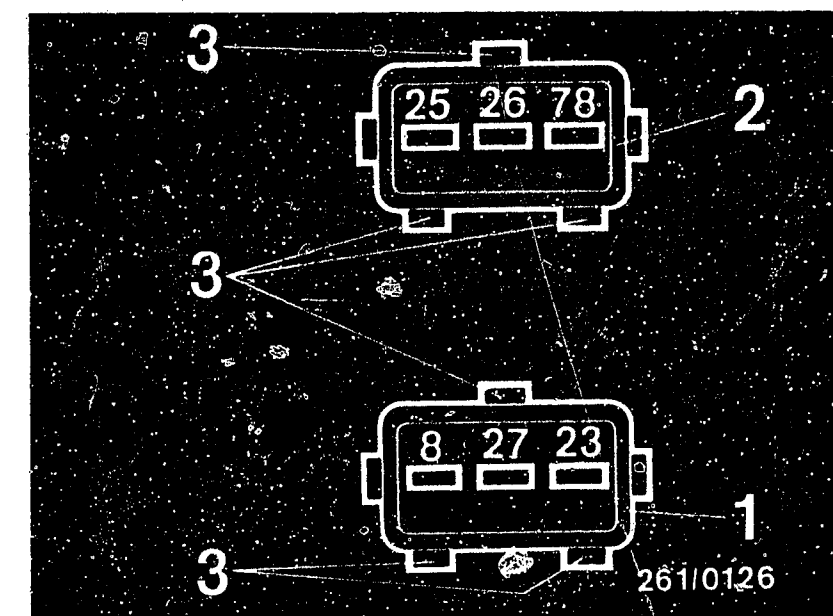
Top view of 35-pin control-unit plug

- 1 = Connector for engine-speed sensor
- 2 = Connector for reference-mark sensor with marking
- 3 = Locating lug

#### Trouble-shooting:

Resistance reading approx. 0  $\Omega$ :  
Check lead 8 for short circuit to ground.

Resistance reading 0.6...1.6 k $\Omega$ :  
Check lead 27 for short circuit to ground.



**C18**

Test with universal test adapter  
Volvo 740/760 Turbo



**C19**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 2			
Operation		Reading	Testing
<u>Program switch position</u> "V"	↓	Multimeter must indicate	<u>Component:</u>  Reference-mark sensor
<u>Program switch position</u> "Ω"	2	<u>Greater than 1 M Ω</u>	
<u>Measuring equipment:</u> Multimeter (Ω range)		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u>  Insulation between Term. 25 and ground
<u>Measuring range:</u>  10 M Ω			<u>Malfunction:</u>  Resistance less than 1 M Ω
<u>Connection:</u>  Test sockets Ω			
<u>Operation in vehicle:</u>  Switch off ignition.			

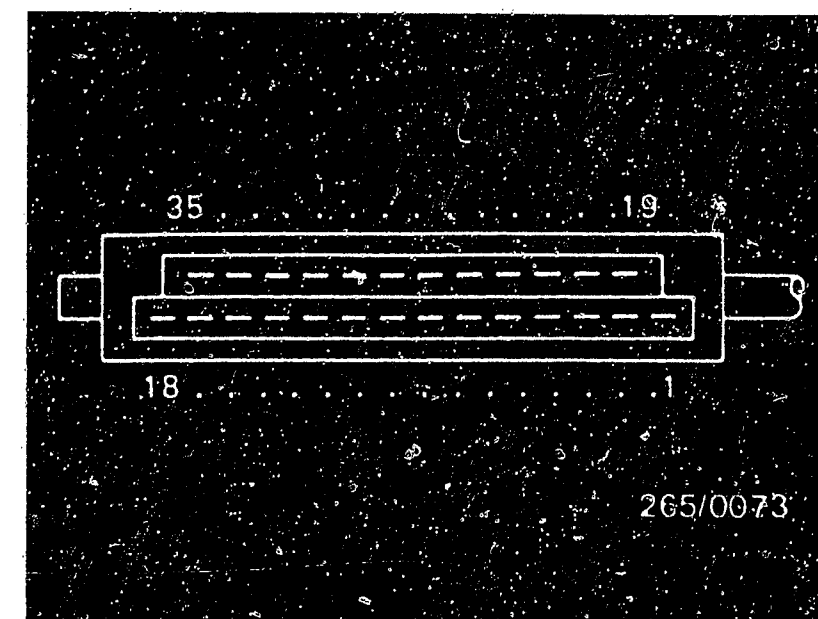
#### Trouble-shooting:

Resistance reading approx. 0 Ω:

Check lead 25 for short circuit to ground.

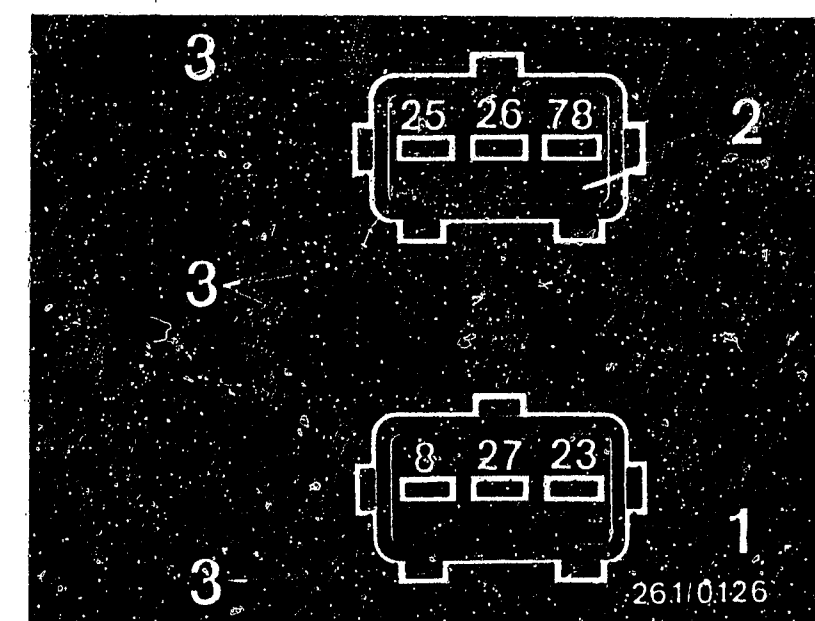
Resistance reading 0.6...1.6 kΩ:

Check lead 26 for short circuit to ground.



Top view of 35-pin  
control-unit plug

- 1 = Connector for engine-speed sensor
- 2 = Connector for reference-mark sensor with marking
- 3 = Locating lug



**C20**


Test with universal test adapter  
Volvo 740/760 Turbo



**C21**

Test with universal test adapter  
Volvo 740/760 Turbo



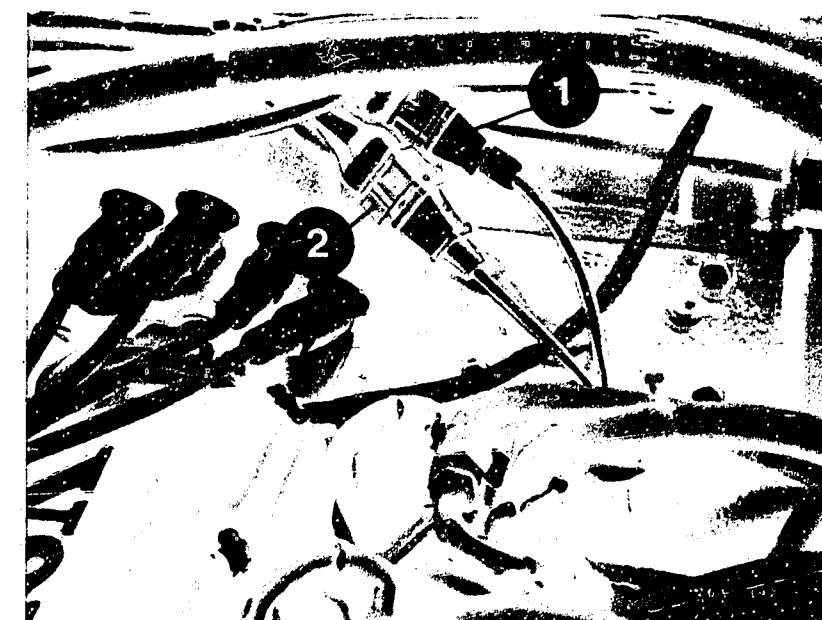
Test step 3			Reading	Testing	
Operation					
<u>Program switch position</u> "V"		3	Multimeter must indicate  <u>0.6...1.6 kΩ</u>	<u>Component:</u>  Engine-speed sensor	
<u>Program switch position</u> "Ω"				<u>Operation:</u>  Winding resistance between Term. 8 and Term. 27	
<u>Measuring equipment:</u> Multimeter (Ω range)				If reading O.K., continue testing with <u>next test step</u>	
<u>Measuring range:</u>  0 to 10 kΩ					
<u>Connection:</u>					Ω
Test sockets					
<u>Operation in vehicle:</u> Switch off ignition					

#### Trouble-shooting:

- Repeat measurement directly at sensor plug.
- Check plug-in connection: Corrosion, loose contact (spring contacts must not allow themselves to be pushed back)
- Check leads from engine-speed sensor Term. 8 and Term. 27 to multiple plug Term. 8 and Term. 27.
- Replace sensor.

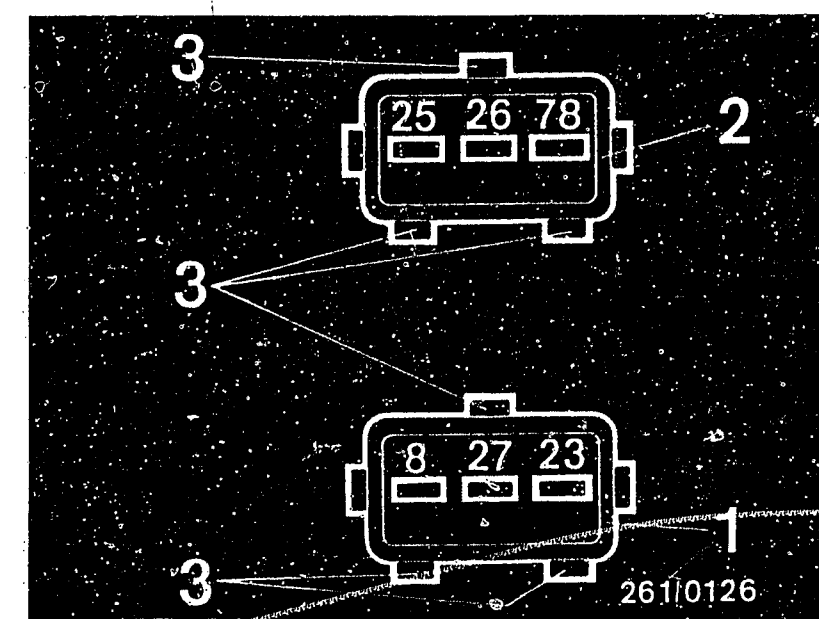
To replace the sensors, undo the plug-in connection and unscrew the hexagon-socket-head cap screw on the sensor. Remove dirt deposits on the sensor. If necessary, apply two screw-drivers to the recesses to left and right of the sensor and raise the sensor. Caution! Do not loosen the mounting.

Continued on D1/D2



Plug connectors of  
1 = Reference-mark sensor  
2 = Engine-speed sensor

Top view of connectors to the sensors  
1 = Connector for engine-speed sensor  
2 = Connector for reference-mark sensor with marking  
3 = Locating lug



**C22**

Test with universal test adapter  
Volvo 740/760 Turbo



**C23**

Test with universal test adapter  
Volvo 740/760 Turbo



### Trouble-shooting - test step 3 (continued)

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets). Grease sensors with "Molykote Longterm 2".

Do not mix up sensors when installing.

(The engine-speed sensor is nearest the engine block).

#### Note marking:

- Leads to reference-mark sensor connector are wound round with adhesive tape.

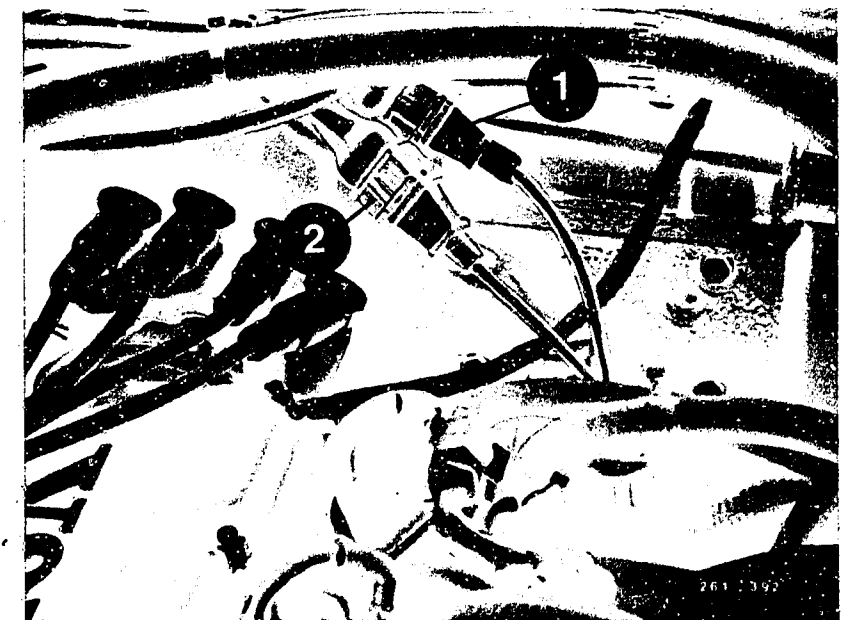
The sensors are plugged into the bore as far as they will go and are secured.

Do not use force when inserting.

When mounting, make sure that the connectors are connected the right way round.

Ensure proper seating and latching of spring contacts in connector.

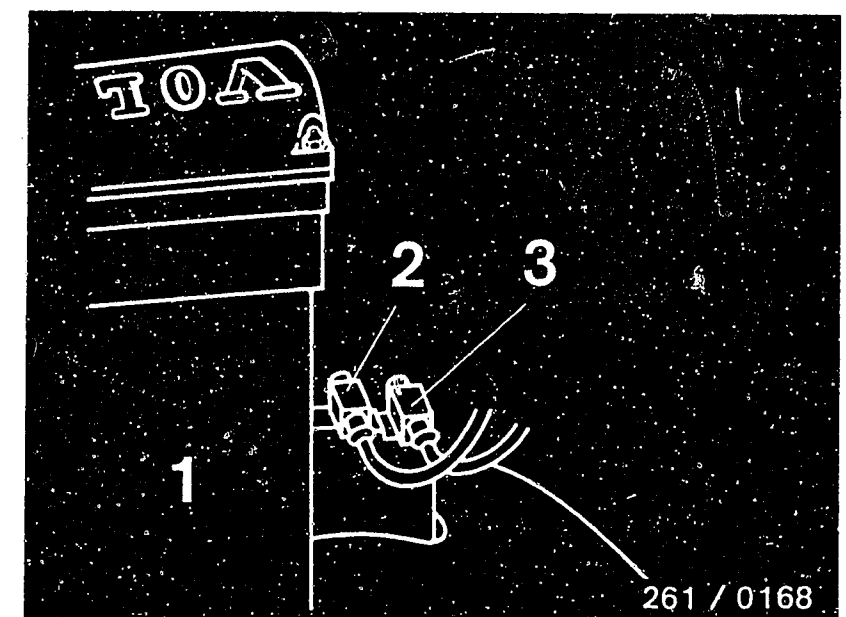
Spring contacts must not allow themselves to be pushed back.



Connectors of

- 1 = Reference-mark sensor
- 2 = Engine-speed sensor

- 1 = Engine block
- 2 = Engine-speed sensor
- 3 = Reference-mark sensor



**D1**

Test with universal test adapter  
Volvo 740/760 Turbo



**D2**

Test with universal test adapter  
Volvo 740/760 Turbo





Test step 4			
Operation		Reading	Testing
Program switch position "V"	↓	Multimeter must indicate  0.6...1.6 k $\Omega$	<u>Component:</u> Reference-mark sensor
Program switch position " $\Omega$ "			
Measuring equipment: Multimeter ( $\Omega$ range)	4	If reading O.K., continue testing with next test step	<u>Operation:</u> Winding resistance between Term. 25 and Term. 26
Measuring range:			
0 to 10 k $\Omega$			
Connection:			
Test sockets	$\Omega$		<u>Malfunction:</u> Resistance outside tolerance.
Operation in vehicle:			
Switch off ignition			

#### Trouble-shooting:

- Repeat measurement directly at sensor plug.
- Check plug-in connection for corrosion, loose contact (spring contacts must not allow themselves to be pushed back)
- Check leads from reference-mark sensor term. 25 and term. 26 to control-unit plug term. 25 and term. 26.
- Replace sensor.

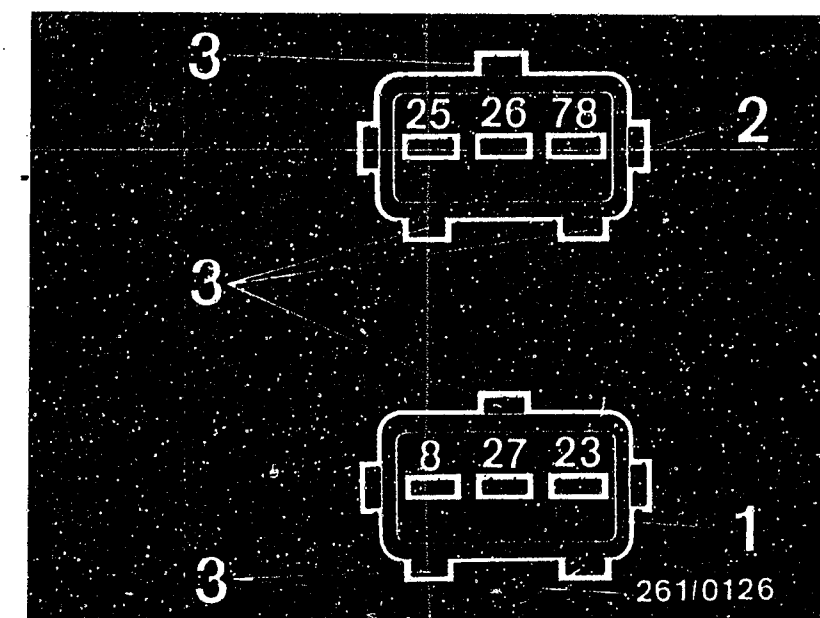
To replace the sensors, unscrew the hexagon-socket-head cap screw on the sensor. Remove dirt deposits from sensor. If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise sensor.

Continued on D5/D6



Plug connectors of  
1 = Reference-mark sensor  
2 = Engine-speed sensor

Top view of connectors to the sensors  
1 = Connector for engine-speed sensor  
2 = Connector for reference-mark sensor with marking  
3 = Locating lug



**D3**

Test with universal test adapter  
Volvo 740/760 Turbo



**D4**

Test with universal test adapter  
Volvo 740/760 Turbo





# Trouble-shooting - Test step 4 (continued)

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets). Grease sensors with Molykote Longterm 2.

Do not mix up the sensors when installing!

Pay attention to markings:

- Leads to reference-mark sensor connector are wound with adhesive tape.

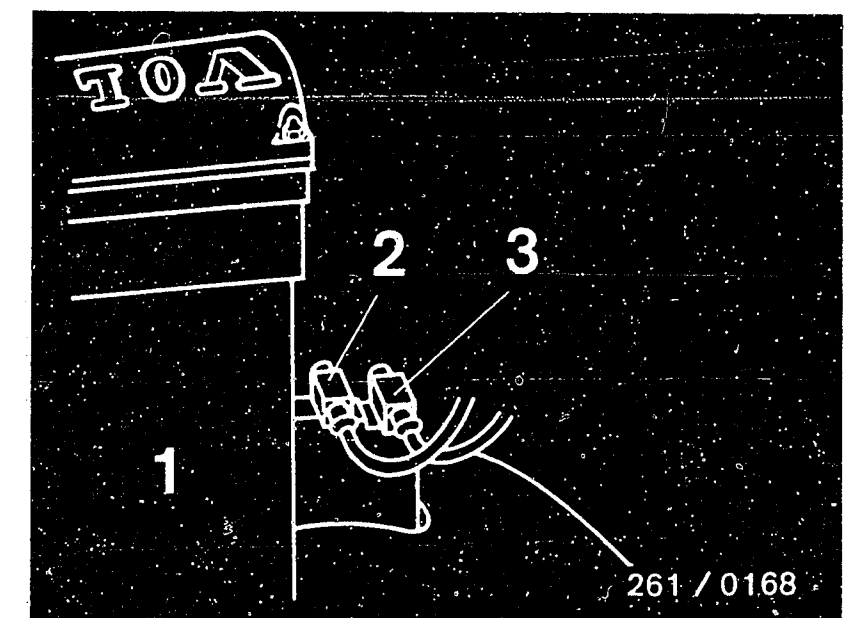
The sensors are plugged into the bore as far as they will go and are secured. Do not use force when inserting.

When mounting, make sure that the connectors are connected the right way round. Ensure proper seating and latching of spring contacts in connector. Spring contacts must not allow themselves to be pushed back.



Connectors of  
1 = Reference-mark sensor  
2 = Engine-speed sensor

1 = Engine block  
2 = Engine-speed sensor  
3 = Reference mark sensor



**D5**

Test with universal test adapter  
Volvo 740/760 Turbo

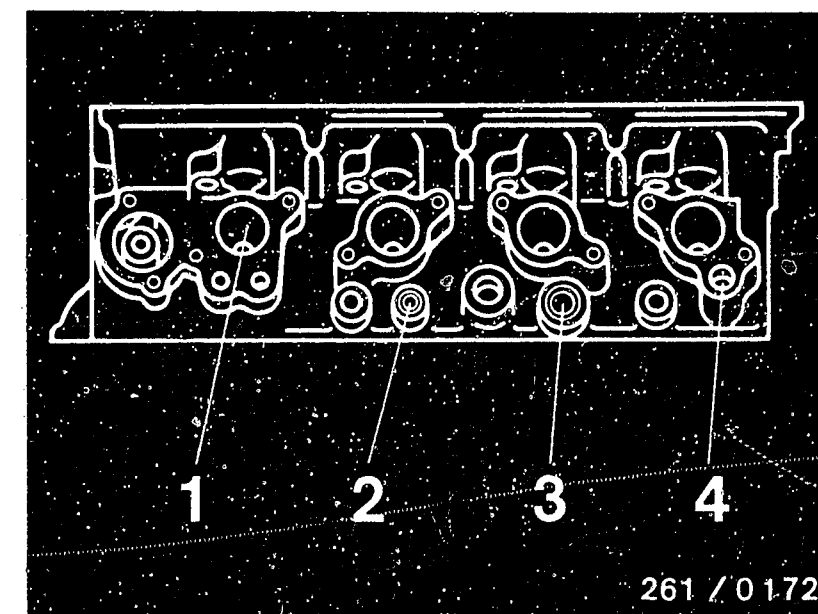


**D6**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 5			
Operation		Reading	Testing
Program switch position "V"	↓	Reading is temperature -dependent, i.e. note engine temperature. At ambient temper- ature (+15°...+30°C): <u>1.45...3.3 kΩ</u>  With engine at normal operating temperature (approx. + 80° C): <u>280...360Ω</u>  If reading O.K., continue testing with next test step.	<u>Component:</u> Double temperature sensor (NTC II, coolant)
Program switch position "Ω"	5		<u>Operation:</u> Resistance between Term. 13 and ground
Measuring equipment: Multimeter (Ω range)			<u>Malfunction:</u> Resistance outside tolerance. Note temperature.
Measuring range: 0 to 10 kΩ			
Connection: Test sockets	Ω		
Operation in vehicle: Switch off ignition			



- 1 = Cylinder 1 (exhaust manifold removed)  
 1 = Sensor for display in instrument panel  
 3 = Engine-temperature sensor (NTC II)  
 4 = Thermo-time switch

#### Trouble-shooting:

- Remove plug from temperature sensor and measure resistance directly. If necessary, replace temperature sensor.
- Check leads from temperature sensor to control-unit plug term. 13 and to ground terminal.
- Eliminate contact resistances at the plug-in connections. Spring contacts must not allow themselves to be pushed back.

**D7**

Test with universal test adapter  
Volvo 740/760 Turbo



**D8**

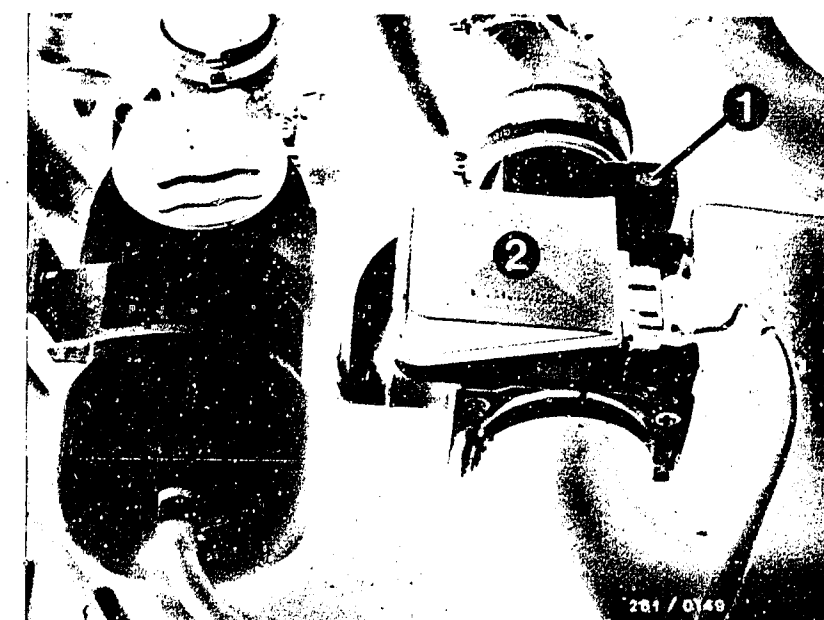
Test with universal test adapter  
Volvo 740/760 Turbo



Test step 6			Testing
Operation		Reading	
Program switch position "V"	↓	Reading is temperature-dependent, i.e. note engine temperature. At ambient temperature (+15°...+30° C): 1.45...3.3 kΩ	Component: Air temperature sensor (NTC I)
Program switch position "Ω"			
Measuring equipment: Multimeter (Ω range)	6	With engine at normal operating temperature (approx. + 80° C): 280...360Ω	Operation: Resistance between Term. 22 and ground
Measuring range: 0 to 10 kΩ			
Connection: Test sockets	Ω	If reading O.K., continue testing with next test step	Malfunction: Resistance outside tolerance. Note temperature.
Operation in vehicle: Switch off ignition			

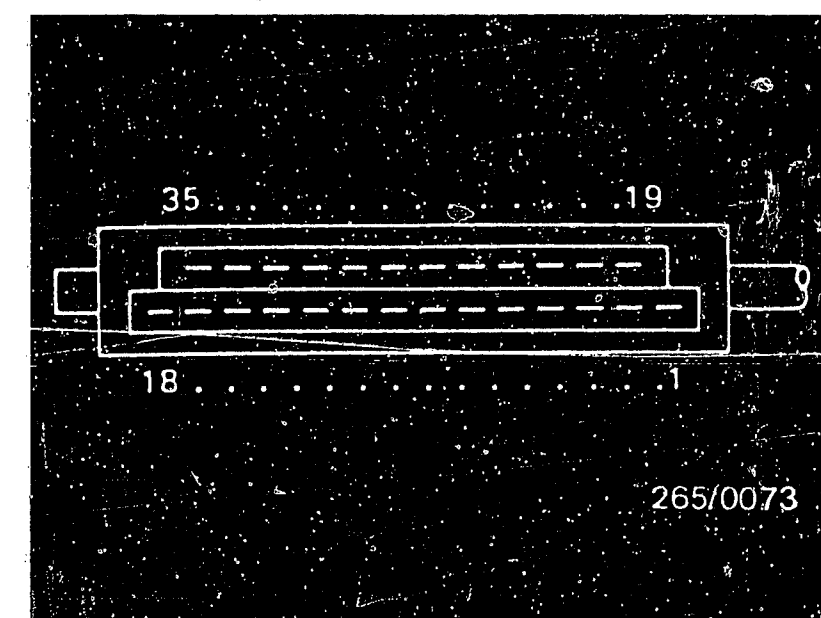
#### Trouble-shooting:

- Remove plug from air-flow sensor and measure resistance directly at Term. 22 and Term. 6. If reading outside tolerance, replace air-flow sensor.
- Leads from air-flow sensor term. 6 and term. 22 to control-unit plug term. 6 and term. 22.
- Eliminate contact resistances in the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.



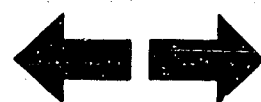
- 1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Top view of 35-pin control-unit plug



**D9**

Test with universal test adapter  
Volvo 740/760 Turbo



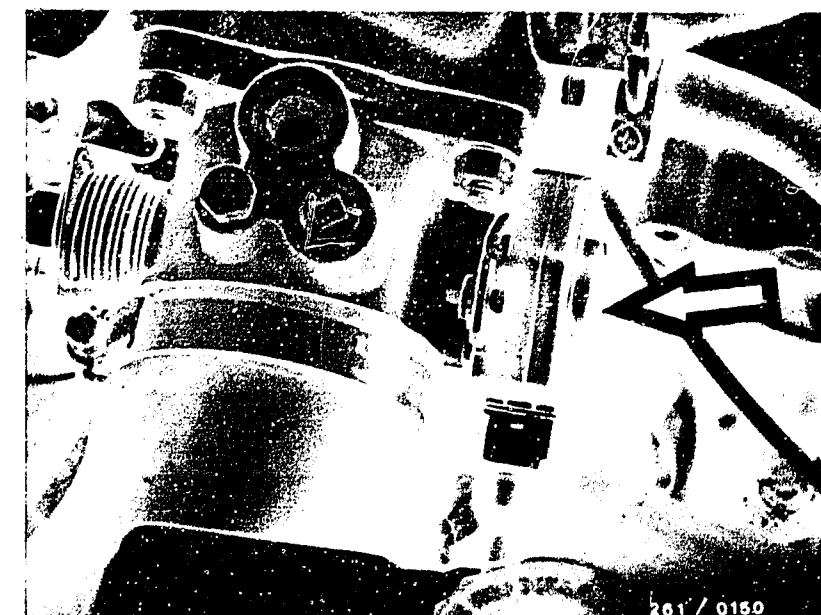
**D10**

Test with universal test adapter  
Volvo 740/760 Turbo



Test steps 7 and 8 deleted!

Test step 9			Reading	Testing
Operation				
Program switch position "V"	↓		Accelerator in rest position: Less than 10 $\Omega$	Component: Throttle-valve switch
Program switch position "Ω"	9		(Measured value is influenced by protective resistor in adapter). Accelerator depressed (Part-load range) : $\infty \Omega$	Operation: Idle contact between terminal 2 and ground
Measuring equipment: Multimeter ( $\Omega$ range)			(Measured value is influenced by internal resistance of ETC control-unit and of idle controller).	Malfunction: Resistance in rest position greater than 10 $\Omega$ or less than $\infty \Omega$ .
Measuring range: 0 to 10 k $\Omega$				
Connection: Test sockets		$\Omega$	If reading O.K., continue testing with next test step.	
Operation in vehicle: Switch off ignition				



Arrow = Throttle-valve switch

#### Trouble-shooting:

##### Adjust throttle-valve switch:

Loosen the fastening screws. Turn the operating lever to full throttle and slowly return to the idle stop. Reading less than 15  $\Omega$ .  
Turn the switch in a clockwise direction until the inner stop can be felt. Tighten screws.

Continued on D13/D14

**D11**

Test with universal test adapter

Volvo 740/760 Turbo



**D12**

Test with universal test adapter

Volvo 740/760 Turbo



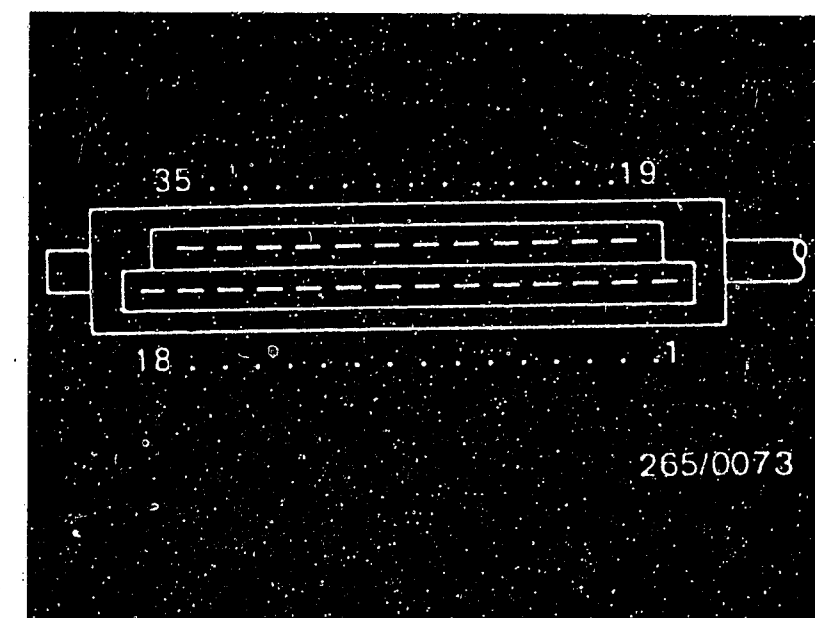
Trouble-shooting - test step 9 (continued)

Check: Slowly open throttle in full-load direction. Reading must change to  $\infty \Omega$  shortly after the throttle is opened.

If no adjustment is possible:

BOSCH throttle-valve switch as well as leads from throttle-valve switch term. 2 and term. 18 to control-unit plug term. 2 and to ground terminal, respectively. Eliminate contact resistances.

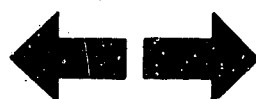
Spring contacts must not allow themselves to be pushed back.



Top view of 35-pin control-unit plug

**D 13**

Test with universal test adapter  
Volvo 740/760 Turbo



**D 14**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 11 (test step 10 deleted)			
Operation		Reading	Testing
Program switch position "V"	↓	Multimeter must indicate Less than 10 $\Omega$ .  (Measured value is influenced by protective resistor in adapter)	Component: Ground lead
Program switch position "Ω"	11		
Measuring equipment: Multimeter ( $\Omega$ range)			Operation: Contact resistance between Term. 16 and ground
Measuring range: 0 to 10 k $\Omega$			
Connection: Test sockets	Ω	If reading O.K., continue testing with next test step	Malfunction: Resistance greater than 10 $\Omega$
Operation in vehicle: Switch off ignition			

#### Trouble-shooting:

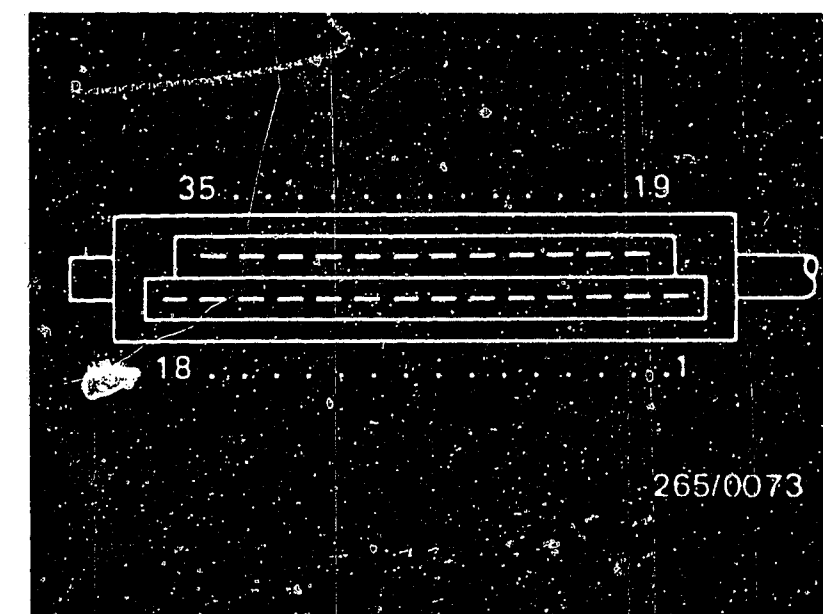
For testing, remove wiring-harness plug from test adapter and, if necessary, use circuit diagram.

Test the following leads for continuity using ohmmeter (set value approx. 0 $\Omega$ ):

- From control-unit plug term. 5 to electronics ground terminal.
- From control-unit plug term. 16 to output stage ground terminal.

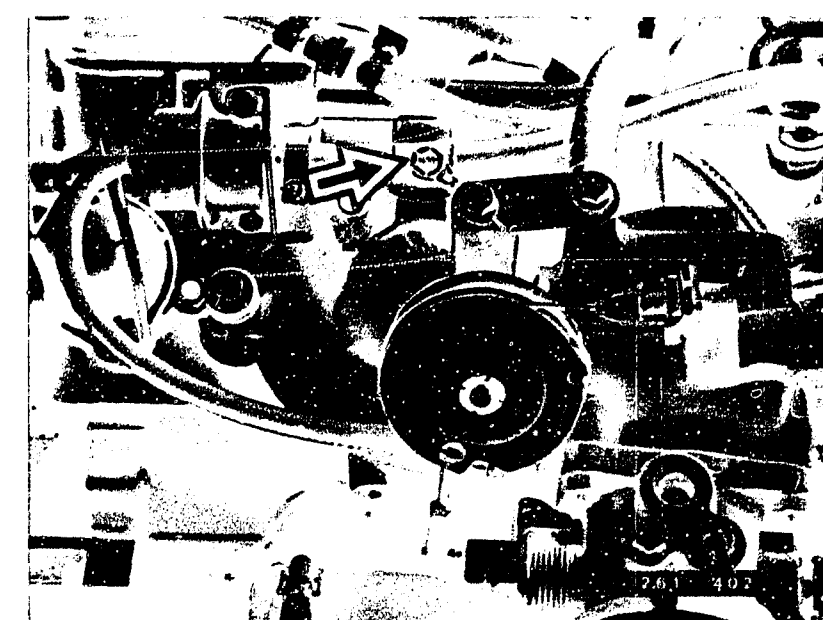
Eliminate contact resistances at connection points.

Spring contacts must not allow themselves to be pushed back.



Top view of 35-pin control-unit plug

Arrow = Ground terminal (fastening screws of fuel-distribution pipe).



**D 15**

Test with universal test adapter  
Volvo 740/760 Turbo

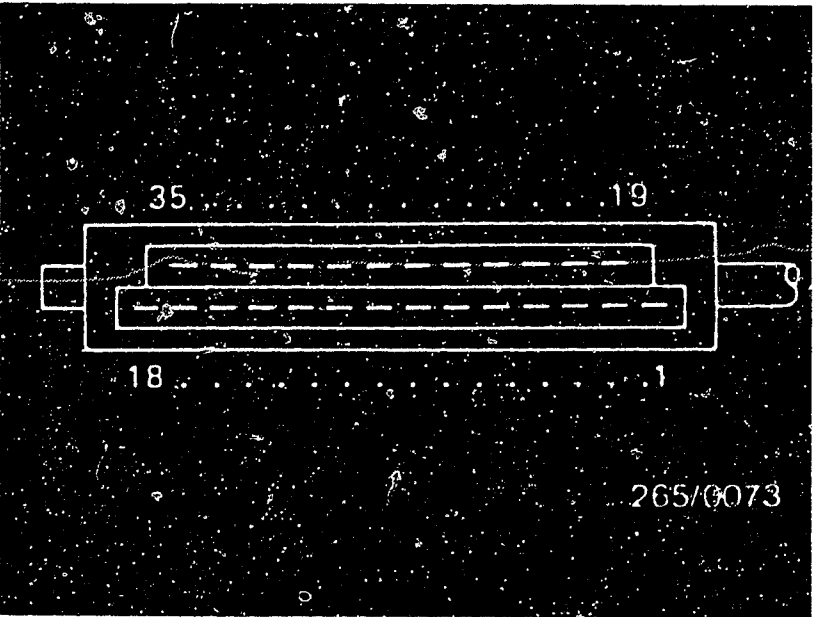


**D 16**

Test with universal test adapter  
Volvo 740/760 Turbo

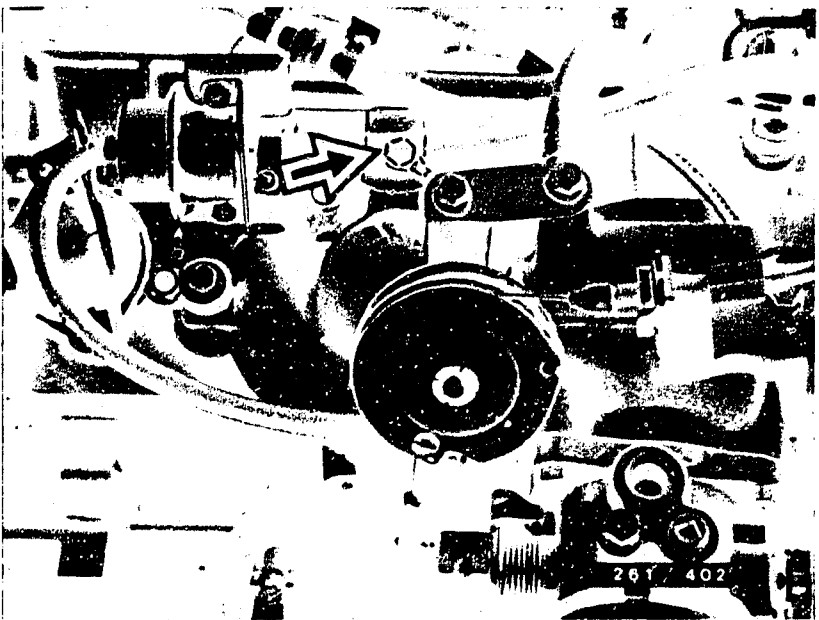


Test step 13 (Test step 12 deleted)			
Operation		Reading	Testing
Program switch position "V"	↓	Multimeter must indicate	Component:
Program switch position "Ω"	13	Less than 10 Ω	Ground lead
Measuring equipment:		(Measured value is influenced by protective resistor in adapter)	Operation:
Multimeter (Ω range)			Contact resistance between Term. 19 and ground
Measuring range:			
0 to 10 kΩ		If reading O.K., continue testing with next test step	
Connection:			Malfunction:
Test sockets	Ω		Resistance greater than 10 Ω
Operation in vehicle			
Switch off ignition			



Top view of 35-pin control-unit plug

Arrow = Ground terminal (fastening screws of fuel-distribution pipe).



Trouble-shooting

For testing, remove wiring-harness plug from adapter and, if necessary, use circuit diagram.

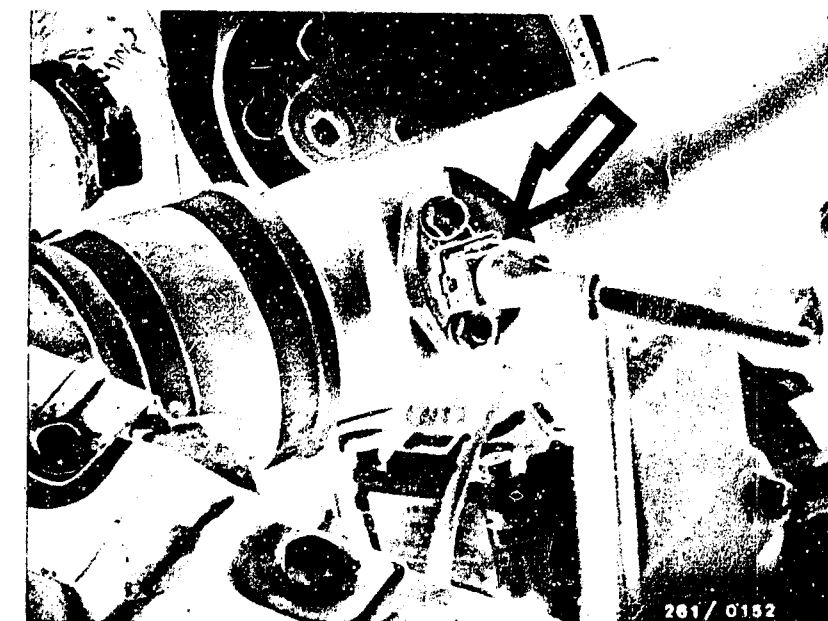
Test the following leads for continuity using ohmmeter (set value approx. 0 Ω)

- From multiple plug term. 19 to electronics ground terminal.
- From multiple plug term. 5 to output stage ground terminal.

Eliminate contact resistances at connection points.

Spring contacts must not allow themselves to be pushed back.

TEST STEP 14:			
Operation:		Reading:	Testing:
<u>Program switch "V"</u> at position:	↓	Measured value is dependent on temperature, i.e. note temperature.  At ambient temperature (+15° ... 30°C): <u>900 ... 1100 Ω</u> at +80°C: <u>1230 ... 1370 Ω</u> If reading O.K., continue testing with next test step.	<u>Component:</u>  Charge-air temperature sensor
<u>Program switch "Ω"</u> at position:	14		
<u>Measuring equipment:</u> Multimeter (Ω range)			
<u>Measuring range:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω		
<u>Operation in vehicle:</u> Switch off ignition			<u>Operation:</u>  Resistance between term. 30 and term. 5 *(ground)
			<u>Malfunction:</u>  Resistance outside tolerance. Note temperature.



Arrow = Charge-air temperature sensor

#### Trouble-shooting:

- Disconnect connector from temperature sensor and measure resistance directly. If necessary, replace temperature sensor.
- Check leads from temperature sensor to control unit plug term. 30 to term. 23.
- Eliminate contact resistances at the plug-in connections. Spring contacts must not allow themselves to be pushed back.

**D 19**

Test with universal test adapter  
Volvo 740/760 Turbo



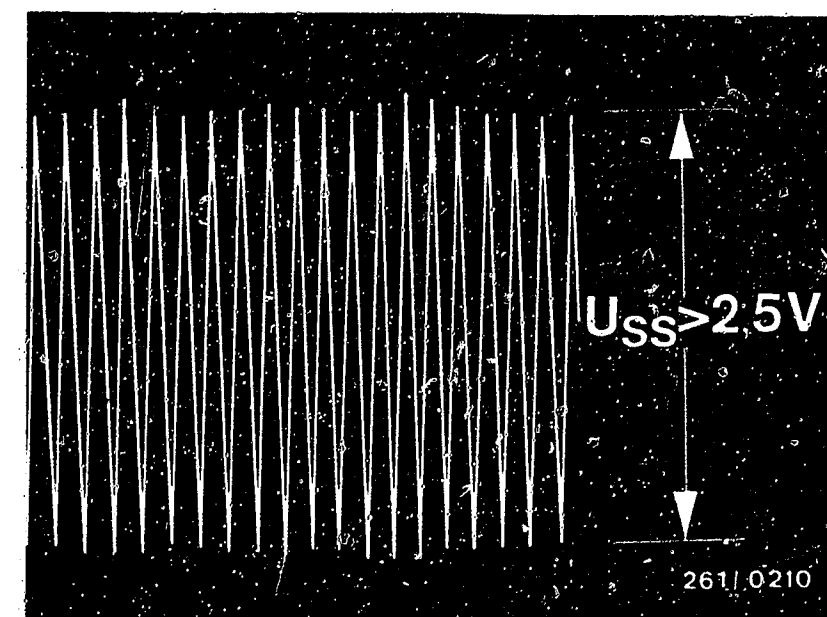
**D 20**

Test with universal test adapter  
Volvo 740/760 Turbo



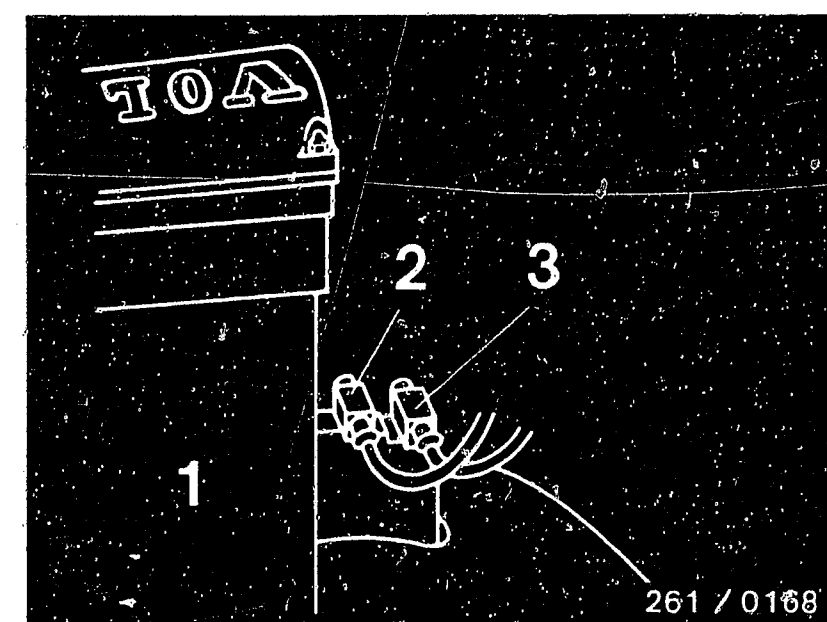


Test step 16 (test step 15 deleted)		
Operation	Reading	Testing
Program switch position "V"	1	<u>Component:</u> Engine-speed sensor
Program switch position "Ω"	15	
<u>Measuring equipment:</u> Motortester, oscilloscope <u>Measuring range:</u> Special input	Engine-speed sensor signal present and $U_{\text{peak-peak}} > 2.5 \text{ V}$ (see top diagram).  Lever to left-hand stop (calibrated voltage range)	<u>Operation:</u> Amplitude (signal) at terminals 8 and 27
Connection: Test wells; red clip to red well, black clip to black well  <u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		<u>Malfunction:</u> No signal or signal too small. Incorrect signal



Engine-speed sensor signal

- 1 = Engine block
- 2 = Engine-speed sensor
- 3 = Reference-mark sensor



#### Trouble-shooting:

No signal or signal too small:

- Cranking speed below  $200 \text{ min}^{-1}$ ; charge battery.
- The air gap (nominal dimension 0.8 mm) can be measured directly with a feeler gauge only with the engine removed. Slide feeler gauge 0.8 mm between ring gear and engine-speed sensor.  
The sensors are mounted in a mounting block and are not adjustable.

**D21**

Test with universal test adapter  
Volvo 740/760 Turbo



**D22**

Test with universal test adapter  
Volvo 740/760 Turbo



## Trouble-shooting - test step 16 (continued)

### Test the air gap with the engine installed as follows:

With the engine-speed sensor removed, measure the length of the sensor with a depth gauge. Make a note of the measurement. Using depth gauge, measure depth of mounting bore as far as top of tooth. Do not measure into tooth gap. The difference between both dimensions (bore depth minus sensor length) may be max. 0.8 mm.

- If signal incorrect (greatly extended in the diagram):  
Heavily damaged tooth on starting-motor ring gear. Replace ring gear.
- Replace engine-speed sensor:  
Unscrew hexagon-socket-head cap screw on sensor. Remove dirt deposits from sensor. If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise sensor.

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets). Grease sensors with "Molykote Longterm 2".

Do not mix up sensors when installing.

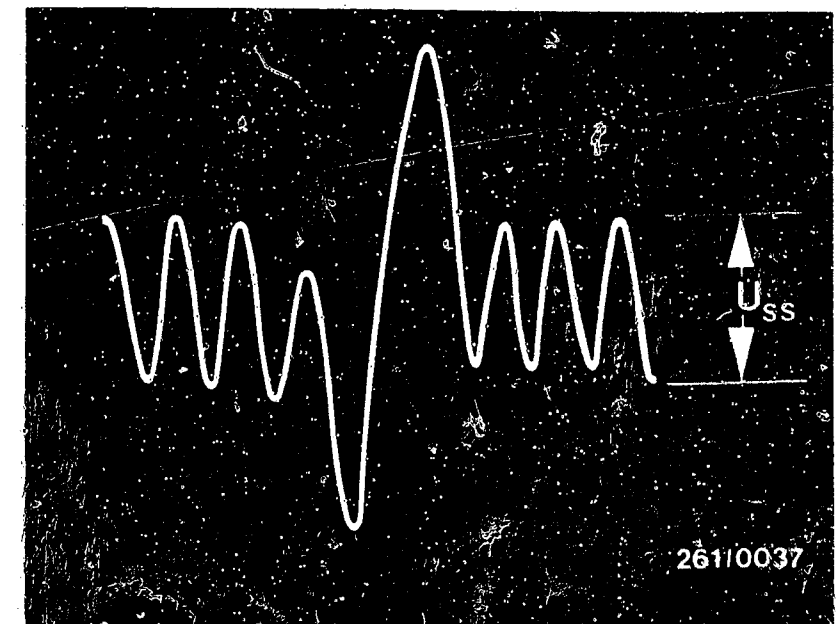
(The engine-speed sensor is nearest the engine block).

### Note marking:

- Leads to reference-mark sensor connector are wound round with adhesive tape.

The sensors are plugged into the bore as far as they will go and are secured. Do not use force when inserting.

When mounting, make sure that the connectors are connected the right way round. Ensure proper seating and latching of spring contacts in connector. Spring contacts must not allow themselves to be pushed back.



Incorrect engine-speed sensor signal

Plug connections of  
1 = Reference-mark sensor  
2 = Engine-speed sensor



**D23**

Test with universal test adapter  
Volvo 740/760 Turbo



**D24**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 17			
Operation		Reading	Testing
Program switch position "V"	2	Reference-mark sensor signal present and $U_A > 2\text{ V}$	<u>Component:</u>  Reference-mark sensor
Program switch position "Ω"			
Program switch position "Ω"		(see top diagram)  Lever to left-hand stop (calibrated voltage range)	<u>Operation:</u>  Amplitude (signal) at terminals 25 and 26
Measuring equipment: Motortester, oscilloscope			
Measuring range:		Lever to left-hand stop (calibrated voltage range)	<u>Malfunction:</u>  No signal or signal too small. Incorrect signal.
Special input			
Connection: Test wells; red clip to red well, black clip to black well		If reading O.K., continue testing with next test step.	
Operation in vehicle: Shift gear to neutral and operate starting motor			

### Testing

#### Component:

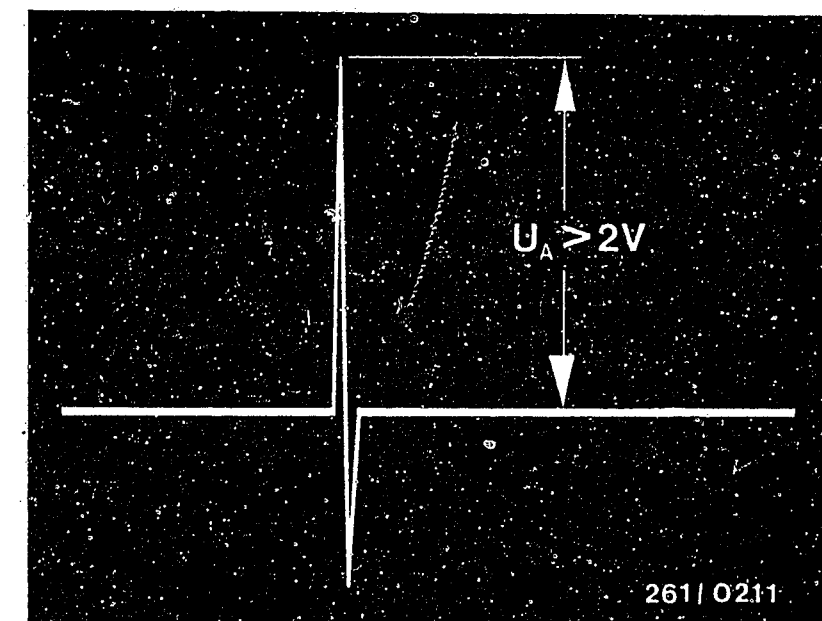
Reference-mark sensor

#### Operation:

Amplitude (signal)  
at terminals 25 and 26

#### Malfunction:

No signal or signal too small.  
Incorrect signal.



Reference-mark sensor signal

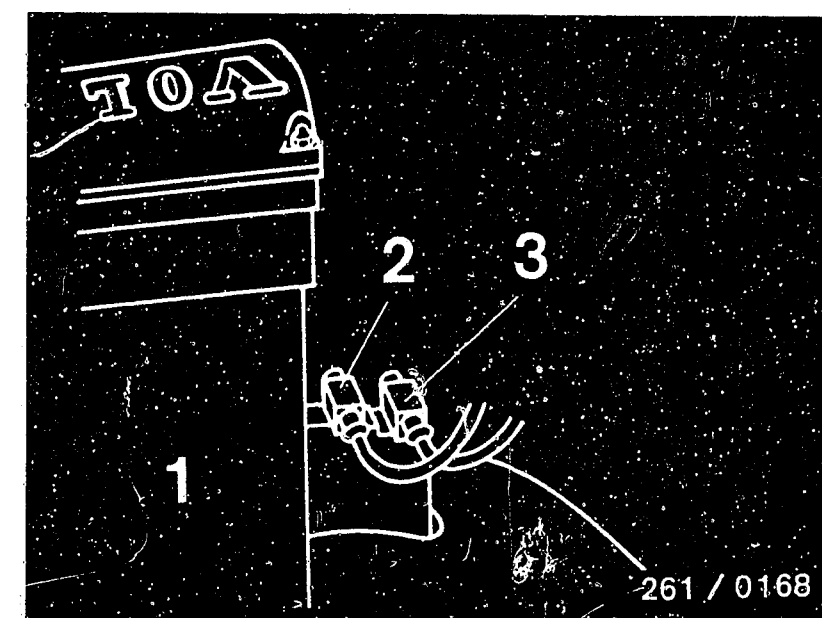
- 1 = Engine block
- 2 = Engine-speed sensor
- 3 = Reference-mark sensor

### Trouble-shooting:

No signal or signal too small:

- Cranking speed below  $200\text{ min}^{-1}$ ; charge battery.
  - The air gap (nominal dimension 0.8 mm) can be measured directly with a feeler gauge only with the engine removed. Slide feeler gauge 0.8 mm between ring gear and engine-speed sensor.
- The sensors are mounted in a mounting block and are not adjustable.

Continued on E3/E4 |



**E1**

Test with universal test adapter  
Volvo 740/760 Turbo



**E2**

Test with universal test adapter  
Volvo 740/760 Turbo



## Trouble-shooting - test step 17 (continued)

- Replacing the reference-mark sensor:

Unscrew hexagon-socket-head cap screw on sensor. Remove dirt deposits on sensor. If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise sensor.

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets): Grease sensors with "Molykote Longterm 2".

Do not mix up sensors when installing.

(The engine-speed sensor is nearest the engine block).

### Note marking:

- Leads to reference-mark sensor connector are wound round with adhesive tape.

The sensors are plugged into the bore as far as they will go and are secured.

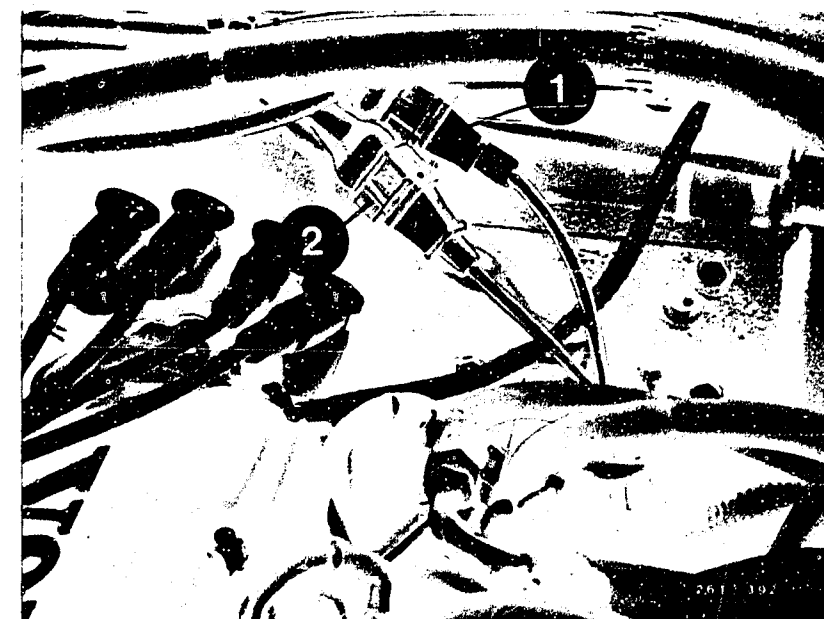
Do not use force when inserting.

When mounting, make sure that the connectors are connected the right way round.

Ensure proper seating and latching of spring contacts in connector.

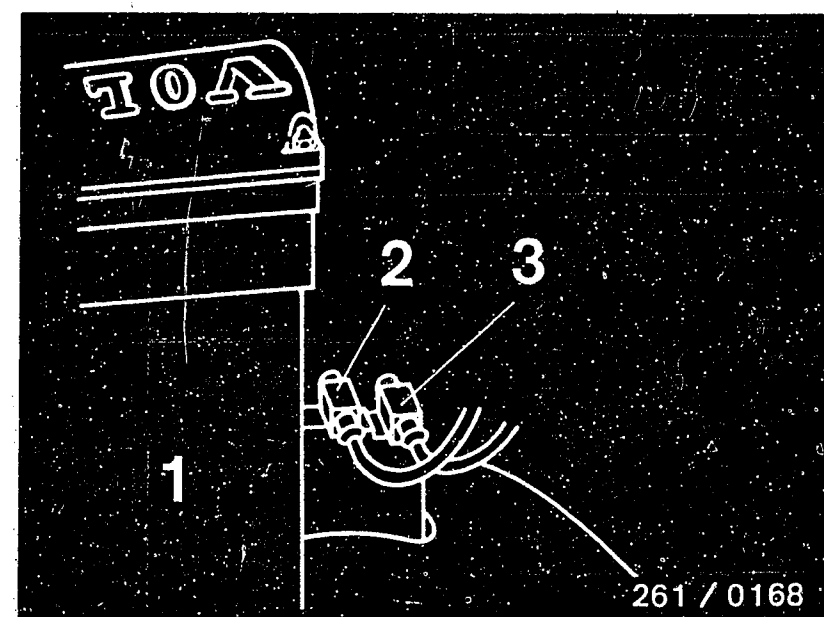
Spring contacts must not allow themselves to be pushed back.

Continued on E5/E6



Connectors of  
1 = Reference-mark sensor  
2 = Engine-speed sensor

1 = Engine block  
2 = Engine-speed sensor  
3 = Reference-mark sensor



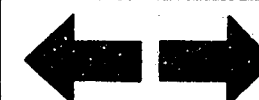
**E3**

Test with universal test adapter  
Volvo 740/760 Turbo



**E4**

Test with universal test adapter  
Volvo 740/760 Turbo

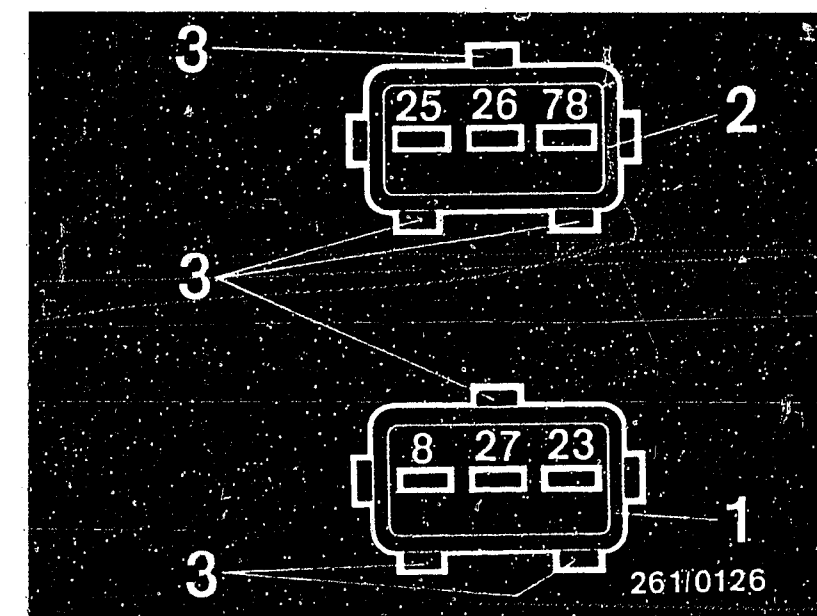


Trouble-shooting - test step 17 (continued)

• Incorrect signal:

Signal incorrect if negative peak comes first.

Check assignment of leads according to terminal diagram and illustration opposite.



Top view of connectors for sensors

1 = Connector for engine-speed sensor

2 = Connector for reference-mark sensor with marking

3 = Locating lug

78, 25, 26, 23, 8, 27 =  
Terminal numbers

**E5**

Test with universal test adapter  
Volvo 740/760 Turbo

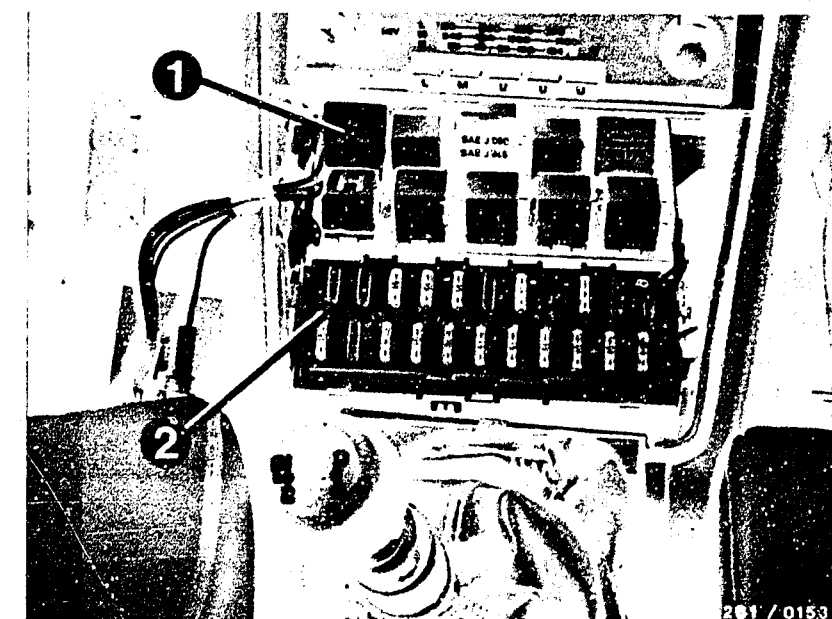


**E6**

Test with universal test adapter  
Volvo 740/760 Turbo

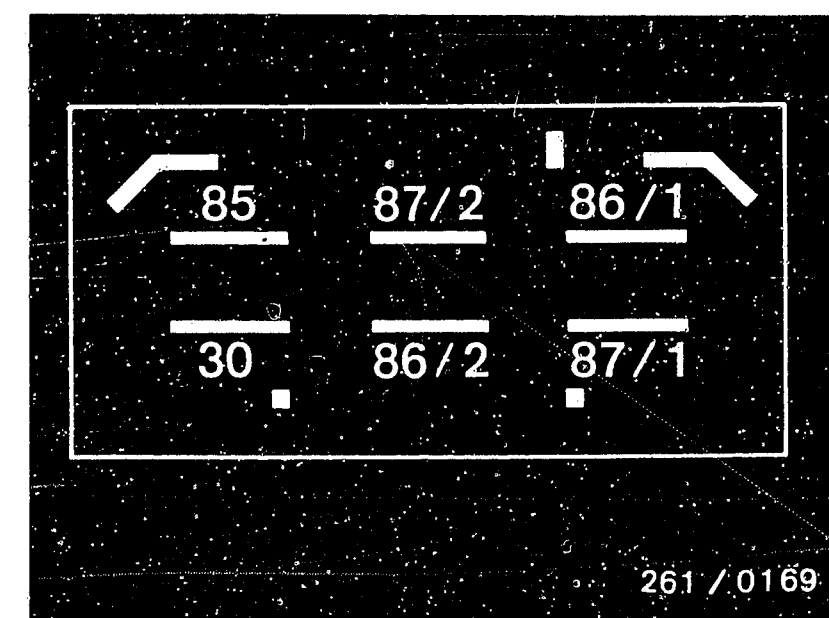


TEST STEP 20: (test steps 18 and 19 deleted) Ignition off. Connect control unit and relay set		
Operation		Reading
Program switch position "V"	6	Multimeter must indicate  10 ... 15 V
Program switch position "Ω"		
Measuring equipment: Multimeter (V range)	15	
Measuring range: 15 V		
Connection: Test sockets, (red = +, black = ground)	V	If reading O.K., continue testing with next test step
Operation in vehicle: Switch on ignition		
		Testing
		Components:  Relay set (main relay)
		Operation:  Supply voltage for control unit at terminals 35 (+) and 5 (ground)
		Malfunction:  Voltage less than 10 V



1 = Relay set  
2 = Fuses

Top view of relay set



#### Trouble-shooting:

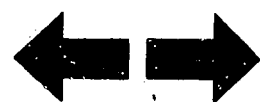
1. Voltage less than 10 V: Battery insufficiently charged or high voltage drops across terminals. Test fuse No. 1.

2. No voltage reading: Check relay set. Perform following voltage measurements at relay with ignition on:

- Measure battery voltage at term. 87/2, term. 85 and term. 30. Measure ground connection term. 86/2 to ground.
- Check lead from relay set term. 30 to control-unit plug term. 35.
- Check Motronic ground terminal on fuel-distribution pipe and ground lead.

**E7**

Test with universal test adapter  
Volvo 740/760 Turbo



**E8**

Test with universal test adapter  
Volvo 740/760 Turbo



# Test step 21

## Operation

Program switch position "V"

7

Program switch position "Ω"

15

Measuring equipment:  
multimeter (V range)

Measuring range:

15 V

Connection: Test sockets,  
(red = +, black = ground)

V

Operation in vehicle:

Switch on ignition

## Reading

Multimeter must indicate

10 ... 15 V

If reading O.K.,  
continue testing with  
next test step

## Testing

### Components:

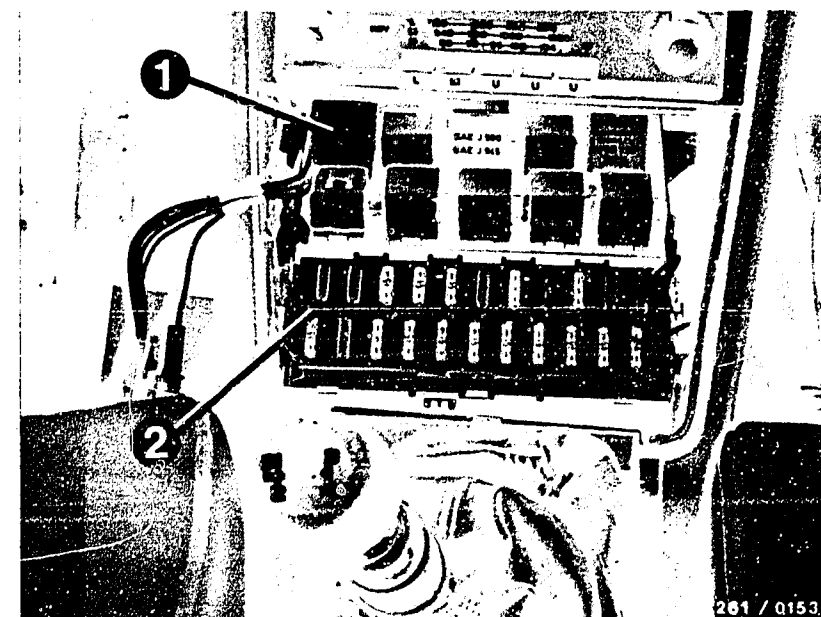
Relay set (main relay)

### Operation:

Supply voltage for control unit  
at terminals 18 (+) and 5  
(ground)

### Malfunction:

Voltage less than 10 V

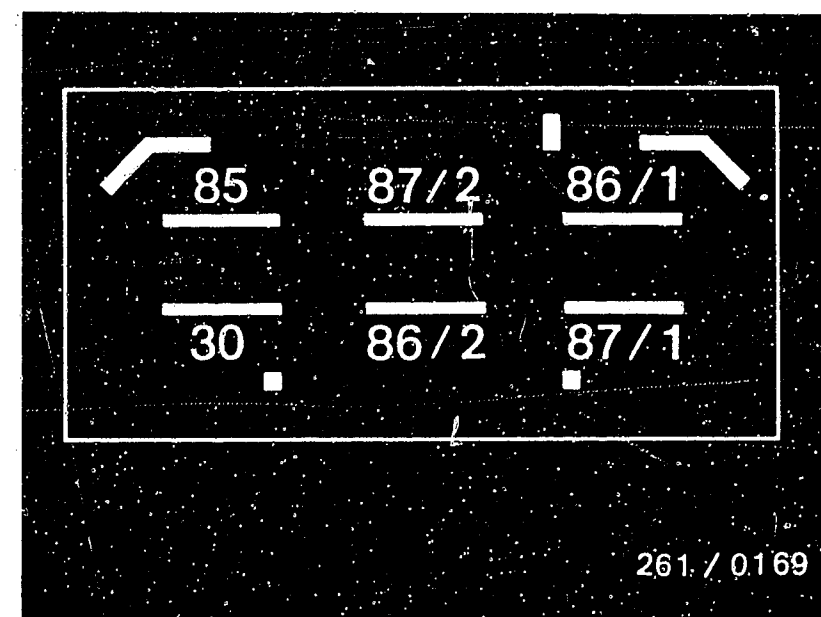


1 = Relay set  
2 = Fuses

Top view of relay set

## Trouble-shooting:

- Check lead from control-unit plug term. 18 to relay set term. 30.



261 / 0169

E9

Test with universal test adapter

Volvo 740/760 Turbo



E10

Test with universal test adapter

Volvo 740/760 Turbo



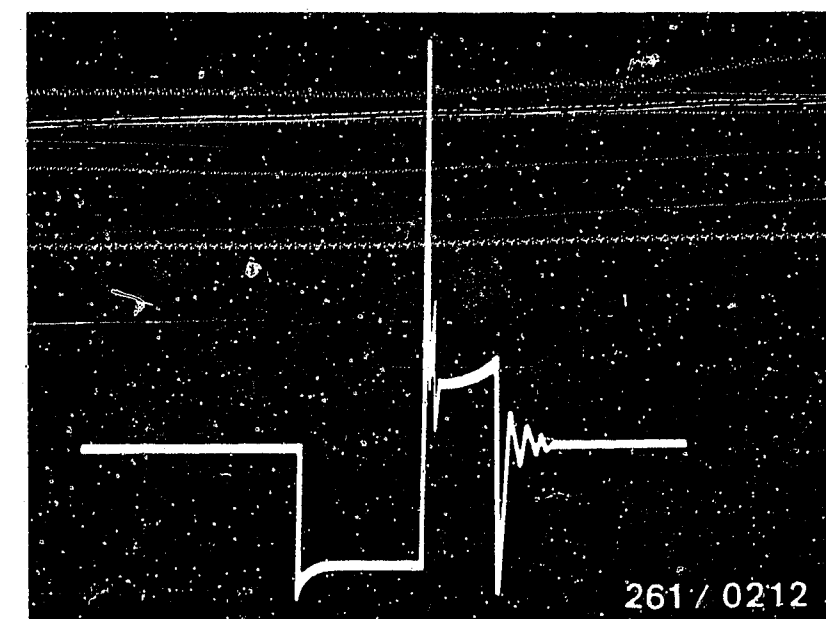
Test step 22			
Operation		Reading	Testing
Program switch position "V"	5	Primary signal present (top diagram)	<u>Component:</u>  Ignition coil, H.T. ignition cables, control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u>  Primary signal from ignition coil terminal 1 to ground
<u>Measuring range:</u> Special input			<u>Malfunction:</u>  No signal or incorrect signal.
<u>Connection:</u> Test wells; red clip to red well, black clip to black well, triggering on cylinder 1			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor			

### Trouble-shooting

- Test Motronic ground terminal on fuel-distribution pipe:  
Terminal must be bare down to the metal and screw must be tight.
- Test ignition coil including leads and high-voltage cables.  
Spring contact on control-unit plug term. 1 must not allow itself to be pushed back.
- Check lead from ignition coil term. 15 to ignition lock term. 15.
- Replace control unit.

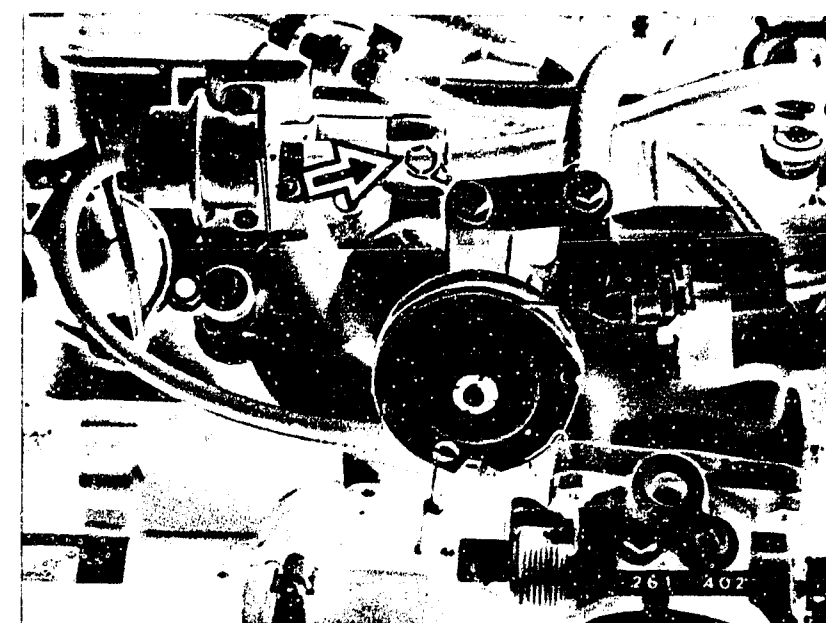
### Note:

To rule out confusion between the control units of the various systems; a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



Ignition signal (primary signal)

Arrow = Ground terminal  
(Fastening screw of fuel-distribution pipe)



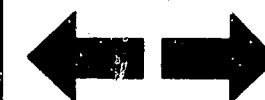
**E11**

Test with universal test adapter  
Volvo 740/760 Turbo



**E12**

Test with universal test adapter  
Volvo 740/760 Turbo





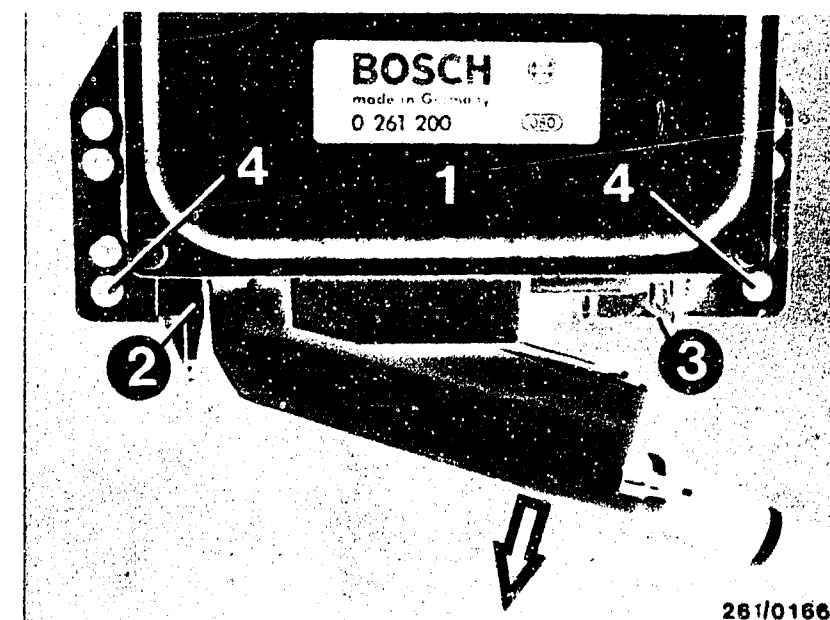
Test step 23			
Operation		Reading	Testing
Program switch position "V"	8	Multimeter must indicate  <u>greater than 7 V</u>	<u>Component:</u>  Control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Multimeter ( V range)			If reading O.K., continue testing with <u>next test step</u>
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets, (red = +, black = Ground)	V	<u>Malfunction:</u>  Voltage less than 7 V	
<u>Operation in vehicle:</u> Switch on ignition			

• Trouble-shooting:

Replace control unit.

Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

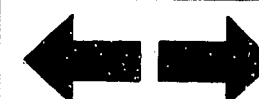
**E13**

Test with universal test adapter  
Volvo 740/760 Turbo

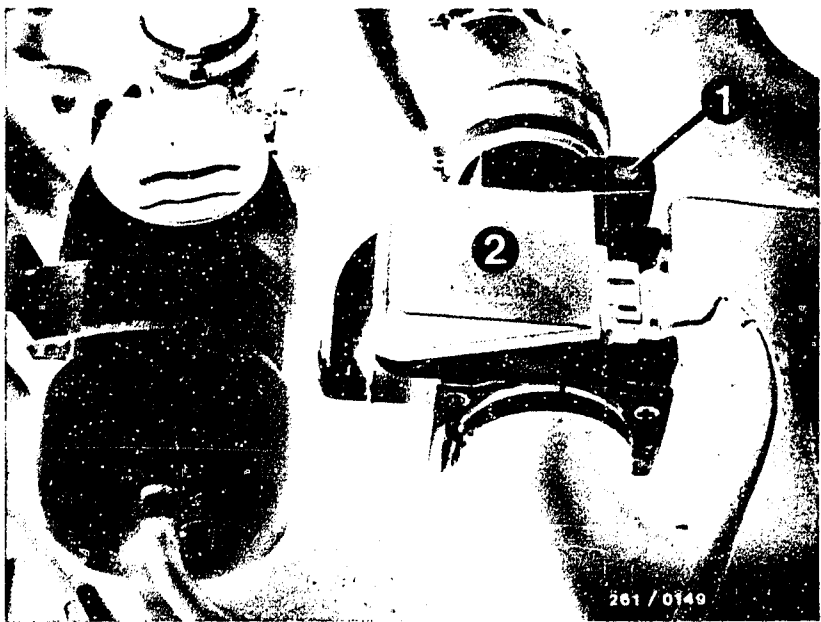


**E14**

Test with universal test adapter  
Volvo 740/760 Turbo

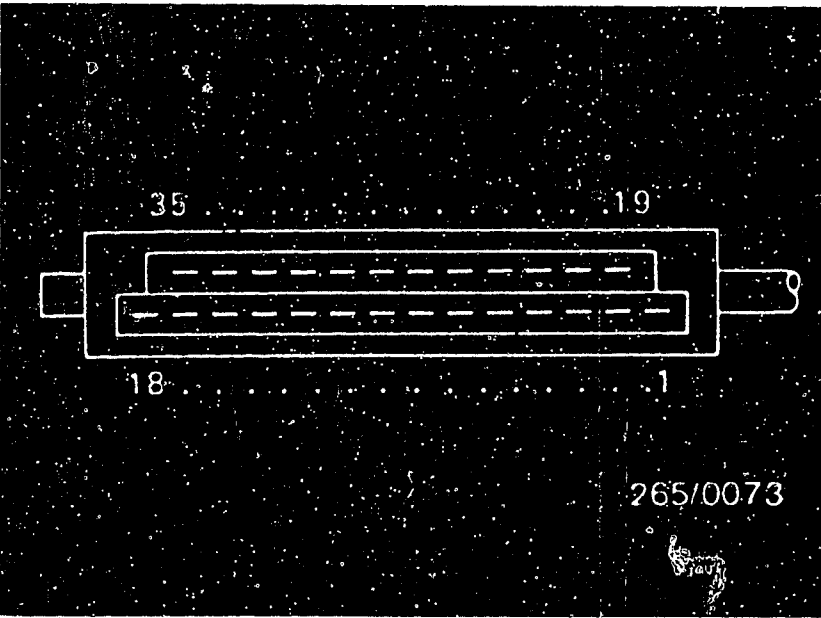


Test step 24			
Operation		Reading	Testing
Program switch position "V"	9	Multimeter must indicate 100 ... 250 mV with sensor flap closed. Loosen hose from air-flow sensor and open sensor flap by hand. Sensor flap must not catch and must return automatically to rest position when released. With sensor flap fully open the reading rises to above 7.0 V (select different measuring range).	Component: Air-flow sensor
Program switch position "Ω"	15		
Measuring equipment: Multimeter (V range)			Operation: Divider voltage at terminal 7 and ground
Measuring range		If reading O.K., continue testing with next test step. Test step 25 deleted.	Malfunction: No voltage or voltage too low
1.5 V and 15 V			
Connection: Test sockets (red = +, black = ground)	V		
Operation in vehicle: Switch on ignition			



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Top view of 35-pin control-unit plug



Trouble-shooting:

No reading:

- Check leads from air-flow sensor term. 6, 7 and 9 to control-unit plug term. 6, 7 and 9.
- Spring contacts must not allow themselves to be pushed back.

Reading outside tolerance:

- Check whether air-flow sensor flap is closing fully.
- Replace air-flow sensor.

**E15**

Test with universal test adapter  
Volvo 740/760 Turbo

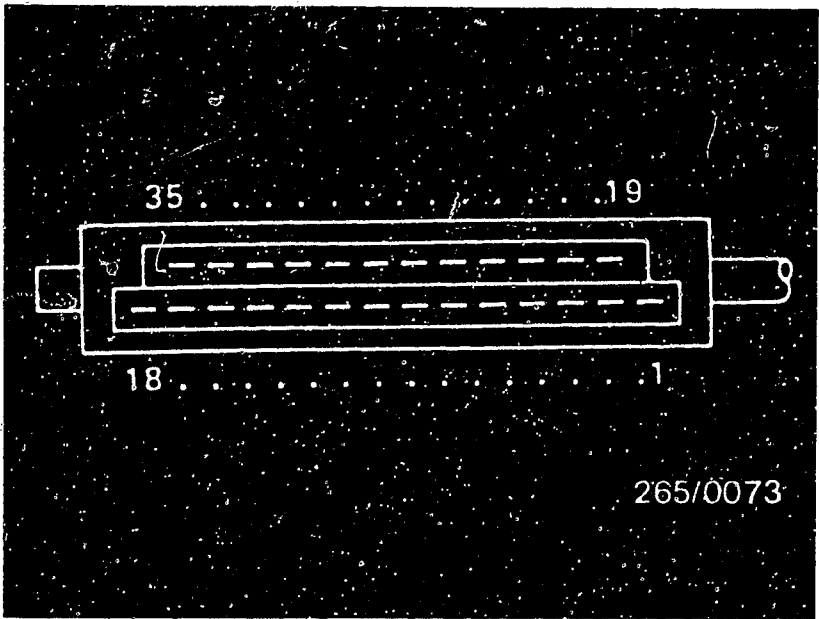


**E16**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 27    (Test steps 25 and 26 not applicable)			
Operation		Reading	Testing
Program switch position "V"	12	Multimeter must indicate  <u>8 ... 15 V</u>  during cranking.	<u>Component:</u>  Lead 4 from starting motor term. 50 to control-unit plug
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Multimeter (V range)			
<u>Measuring range:</u> 15 V			
Connection: Test sockets (red = +, black = ground)	V		<u>Operation:</u>  Voltage test at terminal 4
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor.		If reading O.K., continue testing with <u>next test step</u>	<u>Malfunction:</u>  Voltage less than 8 V



Top view of 35-pin control-unit plug

Trouble-shooting:

1. Voltage less than 8 V:

- Test voltage drop at starting motor terminal 50.
- Check lead from control-unit plug terminal 4 to starting motor terminal 50.

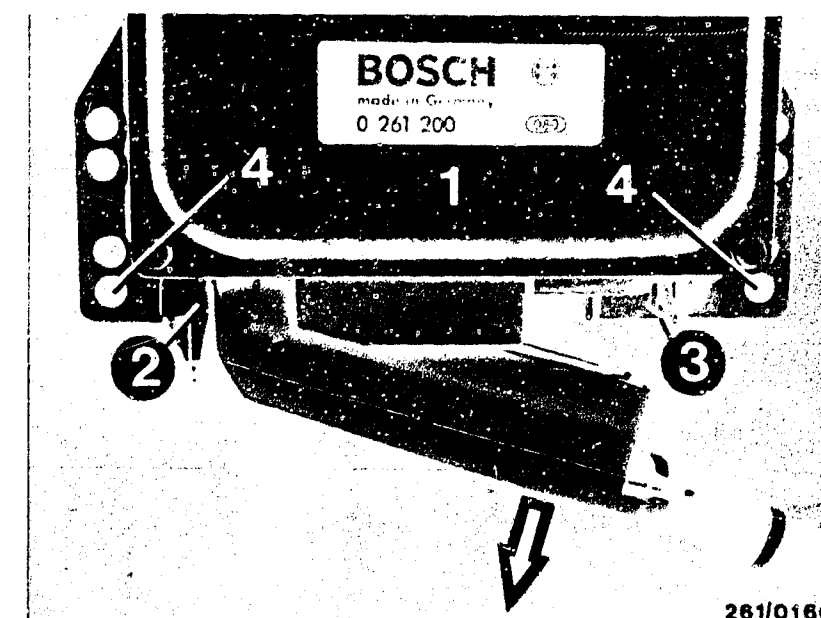
Test step 28		
Operation	Reading	Testing
Program switch position "V"	13	Dwell-period signal present (bottom diagram)
Program switch position "Ω"		
Measuring equipment: Motortester, oscilloscope	15	Component: Control unit
Measuring range: Special input		Operation: Dwell-period signal at terminal 21 to ground
Connection: Test wells; red clip to red well, black clip to black well	If reading O.K., continue testing with next test step	Malfunction: No signal
Operation in vehicle: Shift gear to neutral and operate starting motor		

#### Trouble-shooting:

- Replace control unit

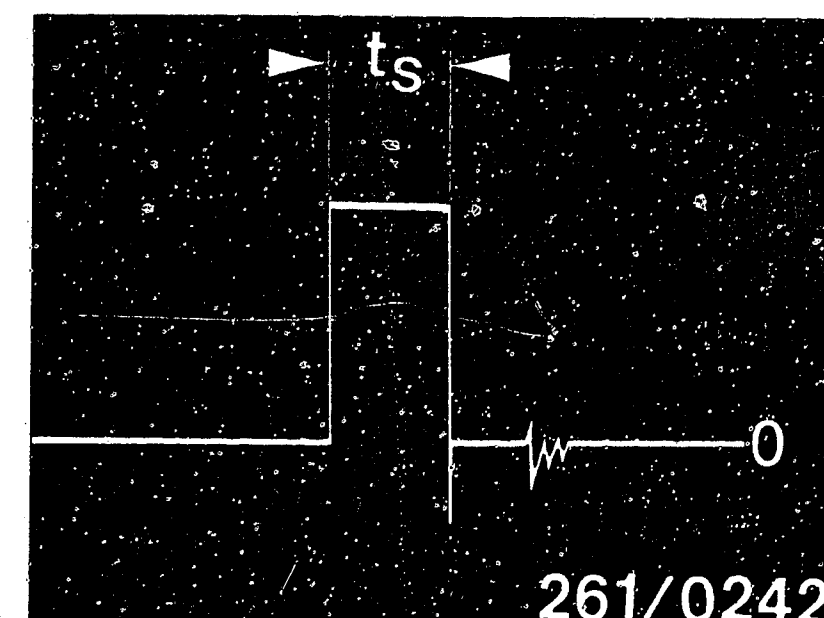
#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



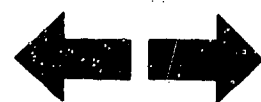
- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

Dwell-period signal  
 $t_s$  = Dwell period



**E19**

Test with universal test adapter  
Volvo 740/760 Turbo



**E20**

Test with universal test adapter  
Volvo 740/760 Turbo



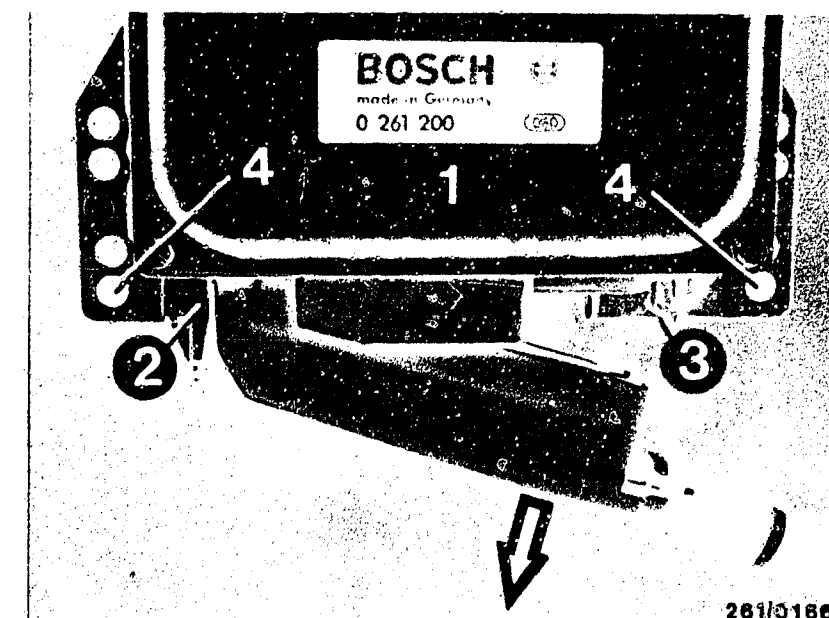
<u>Test step 29</u>		<u>Reading</u>	<u>Testing</u>
<u>Operation</u>			
Program switch position "V"	14	Energization signal for injection output stage present. See bottom diagram for signal shape	<u>Component:</u>  Control-unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u>  Energization of injection output stage at terminal 14 to ground
			<u>Malfunction:</u>  No signal

#### Trouble-shooting:

- Disconnect 25-pin plug to injection output stage (ignition off) and repeat test step. If signal now present, check solenoid-operated injection valves (electrical resistance 2...3 Ω) and series resistors for injection valve (5...7 Ω) or replace injection output stage.
- Replace control unit.

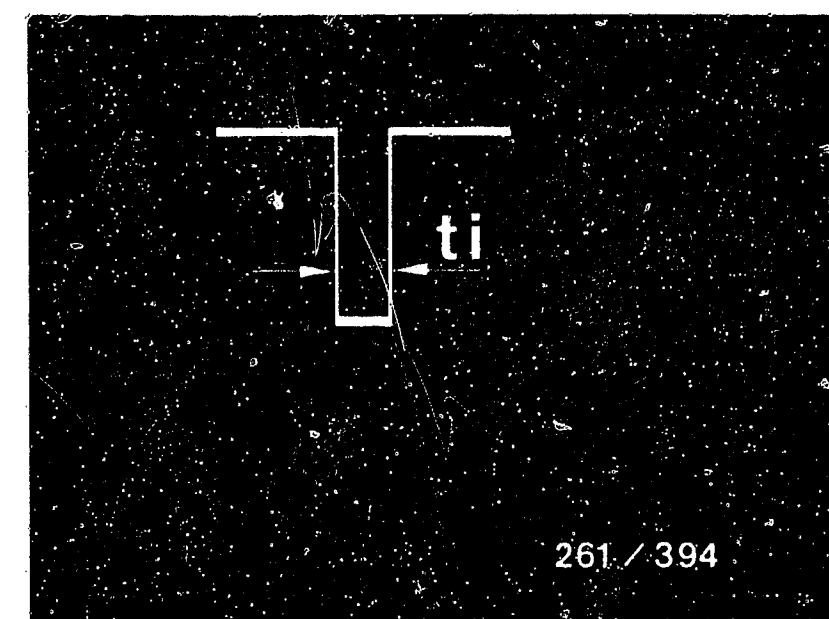
#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes

Energization signal for injection output stage (from Motronic term. 14)  
 $t_i$  = Duration of injection



**E21**

Test with universal test adapter  
Volvo 740/760 Turbo



**E22**

Test with universal test adapter  
Volvo 740/760 Turbo



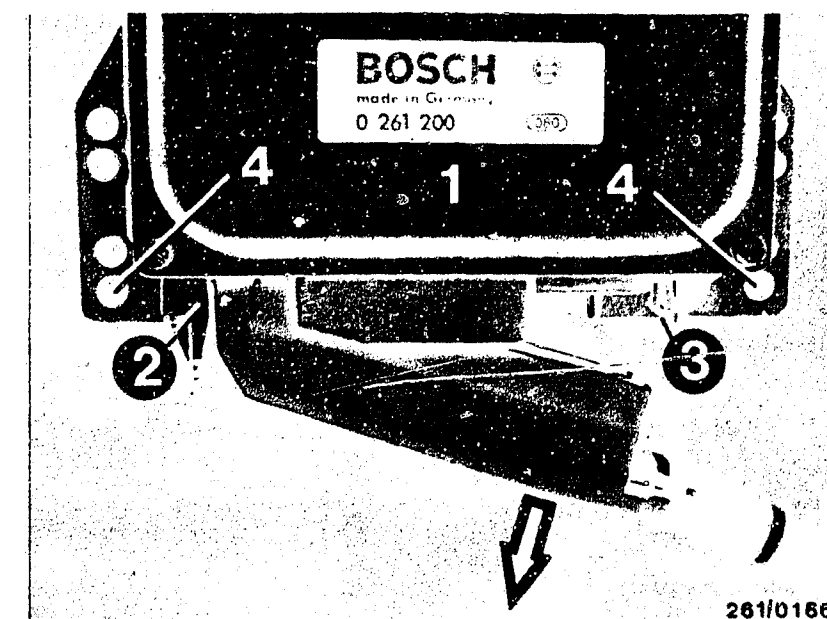
<u>Test step 30</u>		<u>Reading</u>	<u>Testing</u>
<u>Operation</u>			
<u>Program switch position "V"</u>	14	Duration of injection $t_i$ becomes slightly longer after pressing button T1 (NTC II, cold). <u>Press T1 only briefly, otherwise mixture will be over-enriched.</u>	<u>Component:</u>  Control unit
<u>Program switch position "Q"</u>	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor			
<u>Button:</u> Press T1			

#### Trouble-shooting:

Replace control unit

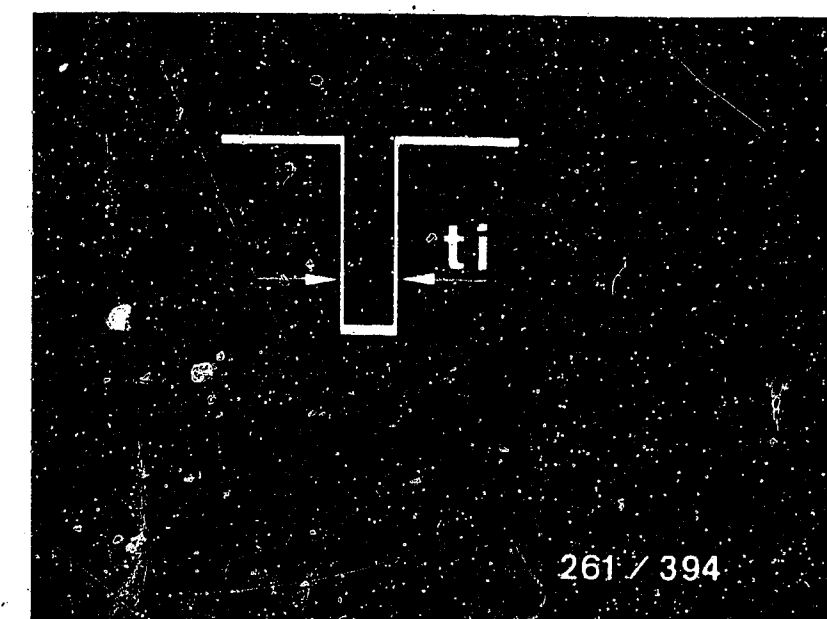
#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes

Energization signal for injection output stage (from Motronic term. 14)  
 $t_i$  = Duration of injection



**E23**

Test with universal test adapter  
Volvo 740/760 Turbo

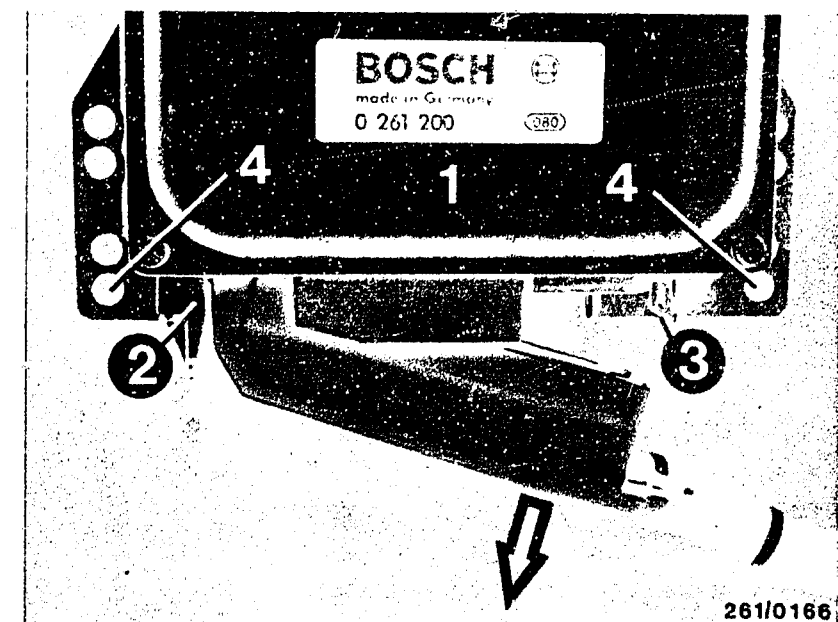


**E24**

Test with universal test adapter  
Volvo 740/760 Turbo

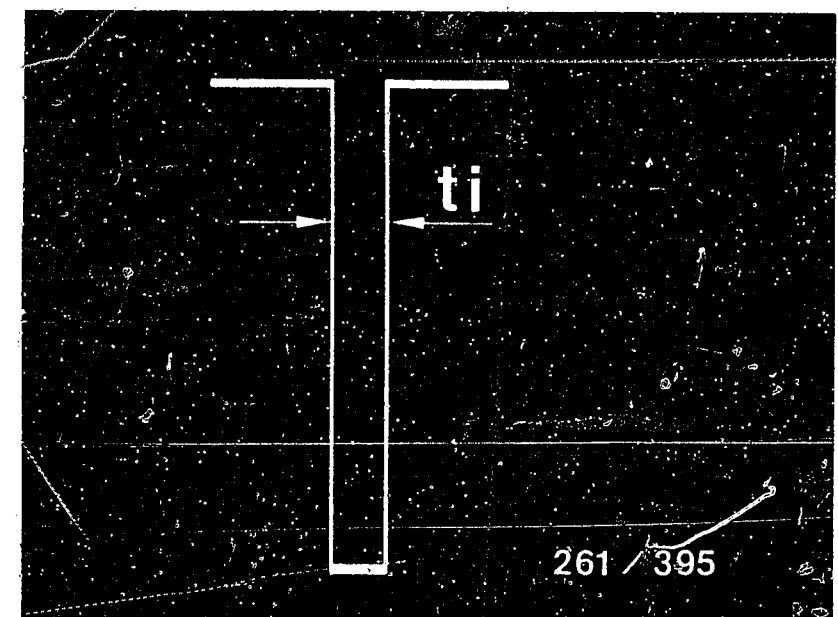


Test step 32 (Test step 31 deleted)			
Operation		Reading	Testing
Program switch position "V"	16	Injection signal present. See bottom diagram for signal shape.	Component:  Control unit
Program switch position "Ω"	15		
Measuring equipment: Motortester, oscilloscope			Operation:  Injection signal at terminal 11 to ground.
Measuring range: Special input			
Connection: Test wells; red clip to red well, black clip to black well		If reading O.K., continue testing with next test step	Malfunction:  No signal
Operation in vehicle: Shift gear to neutral and operate starting motor			



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

$t_i$  = Duration of injection



#### Trouble-shooting:

Replace control unit.

#### Notes:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.

**F1**

Test with universal test adapter  
Volvo 740/760 Turbo

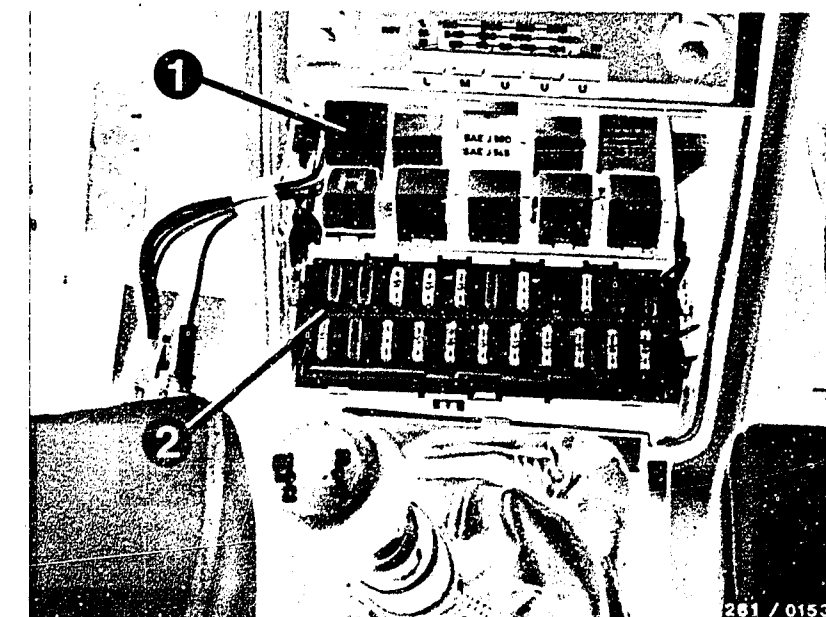


**F2**

Test with universal test adapter  
Volvo 740/760 Turbo



<u>Test step 33</u>			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position</u> "V"	17	Multimeter must indicate  <u>10...15 V</u>	<u>Component:</u>  Relay set (pump relay)
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment':</u> Multimeter (V range)		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u>  Voltage at Term. 20 to ground
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets; (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Ignition on			



1 = Relay set  
2 = Fuses

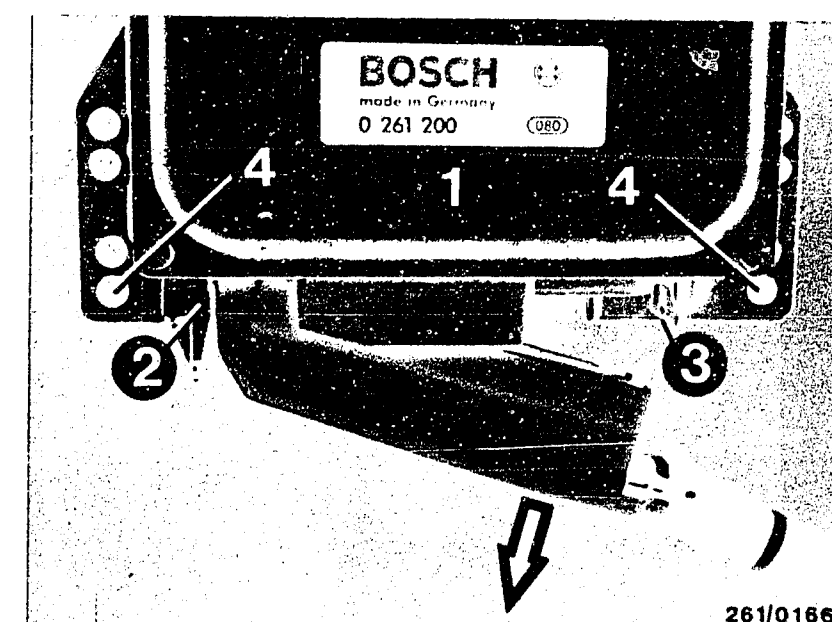
1 = Control unit  
2 = Locating lug  
3 = Detent  
4 = Mounting holes

#### Trouble-shooting:

- Check lead from control-unit plug term. 20 through charge-air pressure relief switch to relay set term. 86/1.
- Charge-air pressure relief switch (installed under instrument panel) defective.
- Replace relay set.
- Replace control unit.

#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



**F3**

Test with universal test adapter  
Volvo 740/760 Turbo



**F4**

Test with universal test adapter  
Volvo 740/760 Turbo





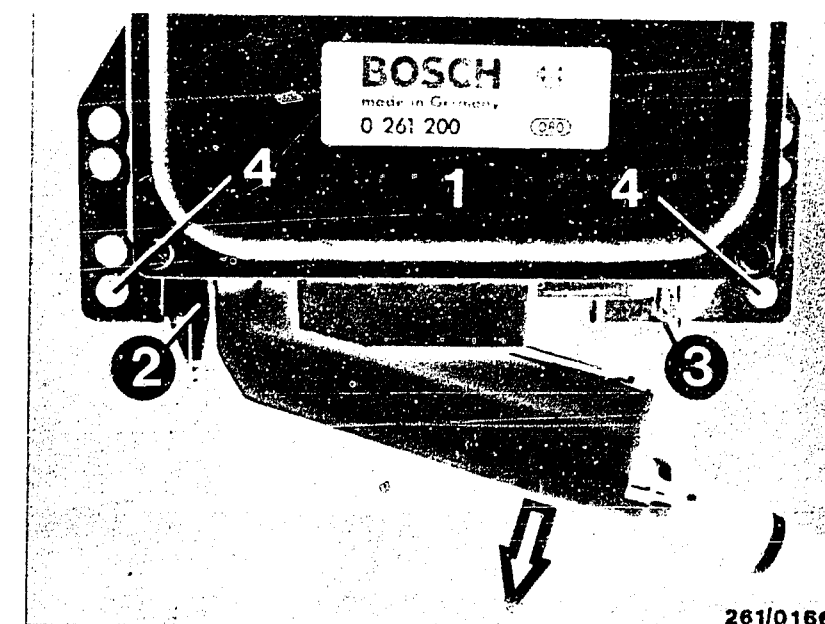
<u>Test step 34</u>			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position "V"</u>	17	Multimeter must indicate  <u>max. 4 V</u>   <	

#### Trouble-shooting:

Replace control unit.

#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

**F5**

Test with universal test adapter  
Volvo 740/760 Turbo



**F6**

Test with universal test adapter  
Volvo 740/760 Turbo

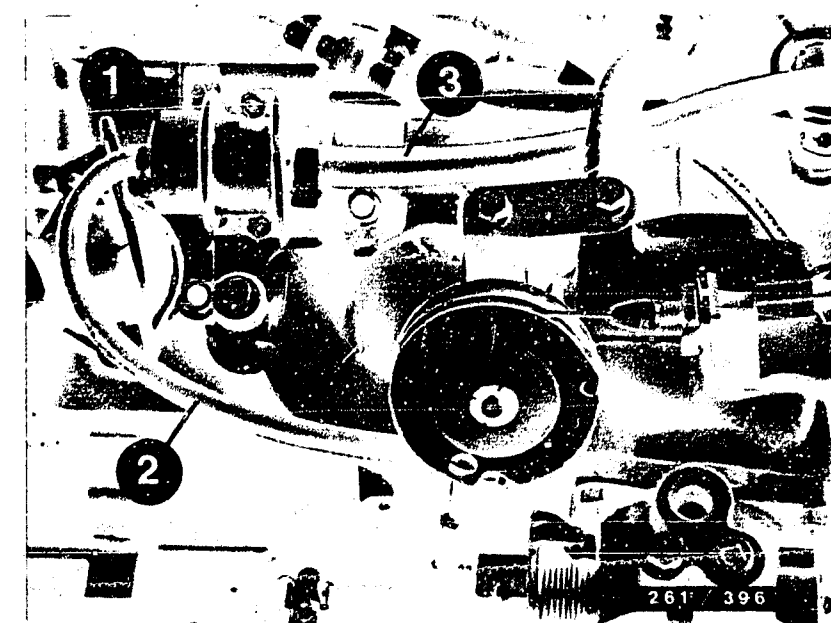


Test step 35   Switch off ignition.   Connect pressure gauge.			
Operation		Reading	Testing
<u>Program switch position</u> "V"	17	Pressure gauge must indicate  <u>2.8 ... 3.2 bar</u>  If reading O.K., continue testing with <u>next test step</u>	<u>Component:</u>  Relay set (pump relay), fuel pump, pressure regulator
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment:</u> Pressure gauge			<u>Operation:</u>  Fuel pressure
<u>Measuring range:</u> 0 to 6 bar			
<u>Connection:</u> On fuel-distribution pipe			
<u>Operation in vehicle:</u> Switch on ignition			
<u>Button:</u> Press T3			
			<u>Malfunction:</u>  No fuel pressure or pressure outside tolerance

Note:  
 Connect pressure tester to fuel-distribution pipe. To do this, unscrew fuel line to start valve.

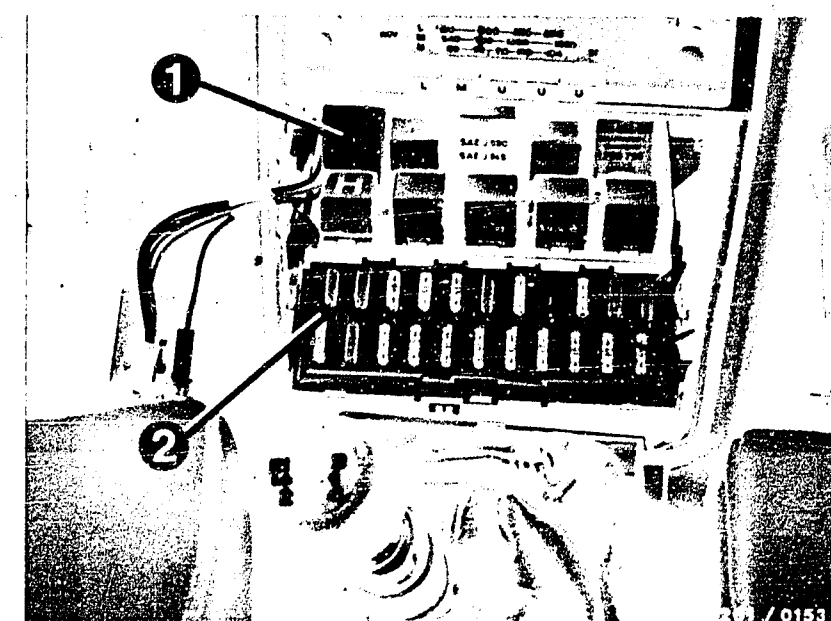
Caution  
 Catch escaping fuel. Danger of fire with hot engine and electrical sparks.

Continued on F9/F10



- 1 = Pressure regulator
- 2 = Vacuum hose
- 3 = Fuel return line

- 1 = Relay set
- 2 = Fuses



**F7**

Test with universal test adapter  
 Volvo 740/760 Turbo



**F8**

Test with universal test adapter  
 Volvo 740/760 Turbo



Trouble-shooting - test step 35 (continued)

1. Pressure 0 bar, no pumping noises can be heard:

- Test pump fuse.
- Replace relay set.
- Measure voltage at disconnected pump plug.

No voltage:

Check lead from fuel pump to relay set Term. 87b as well as pump ground lead.

If voltage not sufficient:

Test lead from fuel pump to pump relay term. 87 as well as pump ground lead.

- If voltage present:

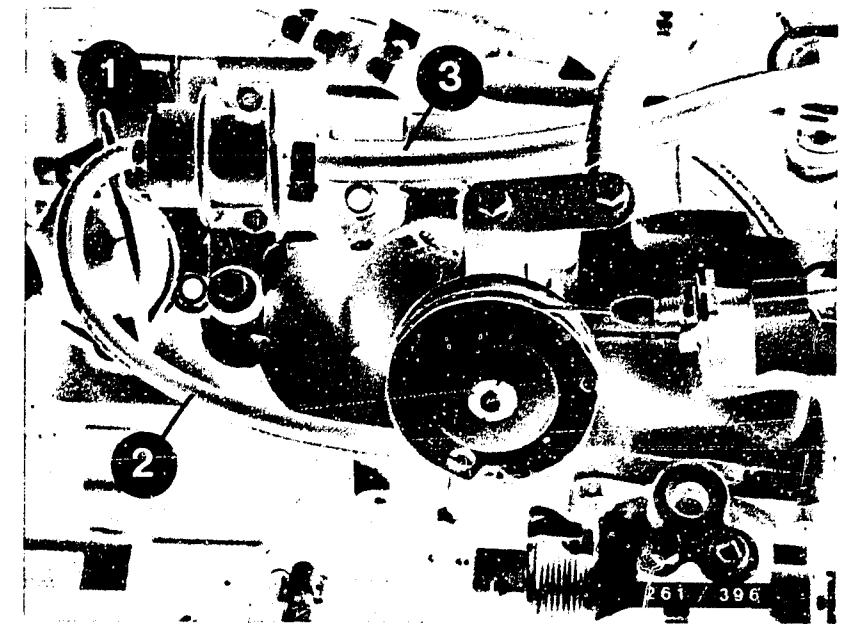
Test pressure regulator and fuel pump as described below under 2.

2. Pressure outside tolerance, fuel pump operating:

- Fuel pressure too low:

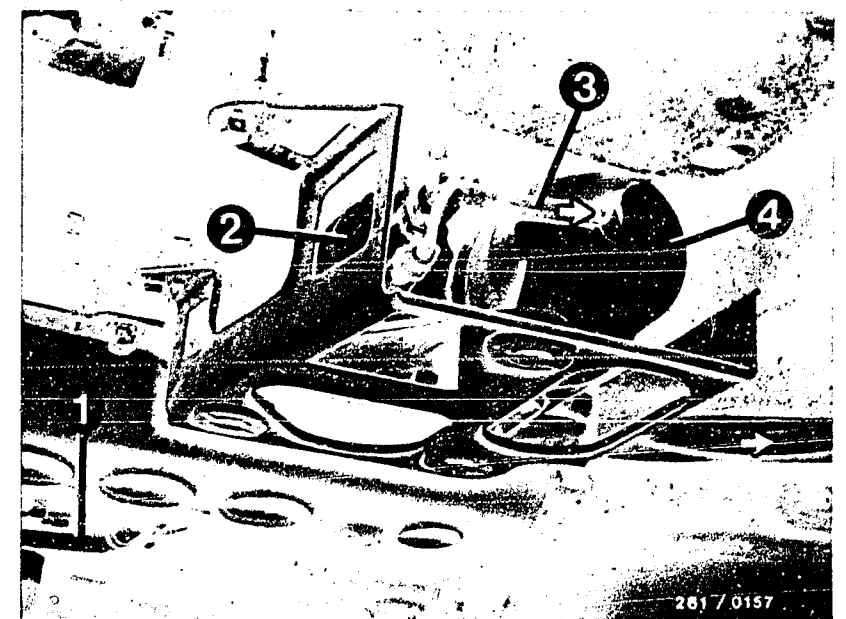
Slowly pinch off return line with hose clammer (cution! do not load pressure tester above 6 bar!). If pressure rises above 4 bar, replace pressure regulator. If pressure remains below 4 bar, replace fuel pump.

Continued on F11/F12



- 1 = Pressure regulator
- 2 = Vacuum hose
- 3 = Fuel return line

- 1 = Fuel intake line
  - 2 = Electric fuel pump
  - 3 = Fuel delivery line
  - 4 = Fuel filter
- Arrows = Direction of flow



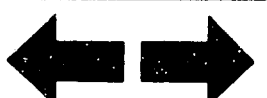
**F9**

Test with universal test adapter  
Volvo 740/760 Turbo



**F10**

Test with universal test adapter  
Volvo 740/760 Turbo



Touble-shooting - TEST STEP 35 (continued)

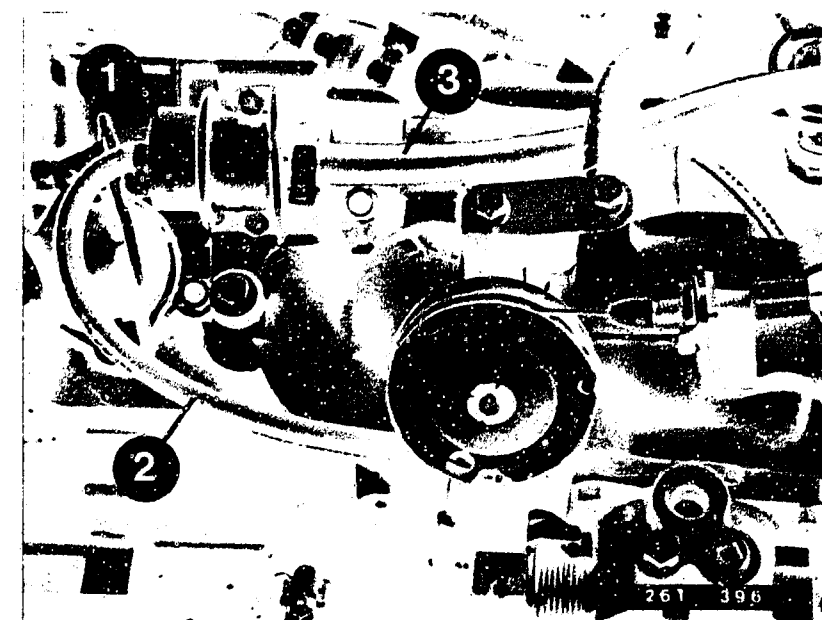
- Check fuel line and fuel filter for throughflow. Fuel lines pinched?
- Strainer in tank clogged?
- Corrosion in tank?
- Check fuse no. 11 for pre-supply pump.

• Pre-supply pump defective

Testing: Remove hose from intake fitting of main electric fuel pump and hold in measuring glass. Start stopwatch and measure time until measuring glass is half full. Empty measuring glass and hold hose in measuring glass again. Switch on pre-supply pump and start stopwatch and measure time until measuring glass is half full again. Compare times. With pre-supply pump on the filling time is shorter.

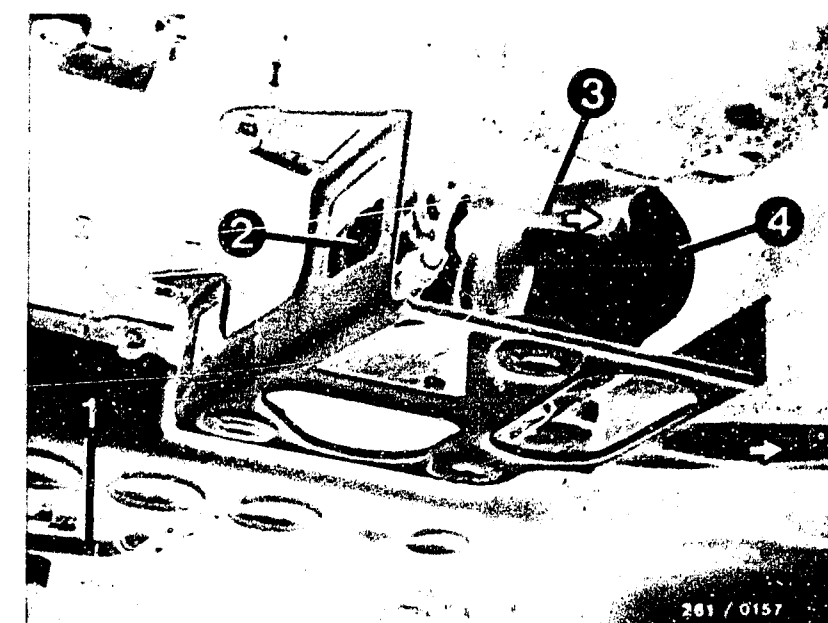
3. Fuel pressure above 3.2 bar:

- Fuel return line clogged or pinched.
- Replace pressure regulator.



- 1 = Pressure regulator
- 2 = Vacuum hose
- 3 = Fuel return line

- 1 = Fuel intake line
- 2 = Electric fuel pump
- 3 = Fuel delivery line
- 4 = Fuel filter
- Arrows = Direction of flow



**F11**

Test with universal test adapter  
Volvo 740/760 Turbo



**F12**

Test with universal test adapter  
Volvo 740/760 Turbo



### CAUTION!

The following test steps can only be performed with the engine running.  
If the engine will not run, continue with the trouble-shooting program of your choice.  
Detailed trouble-shooting - see C3 - C4  
Direct trouble-shooting - See C5 - C10  
For further trouble-shooting, leave the test adapter, control unit and pressure gauge connected.

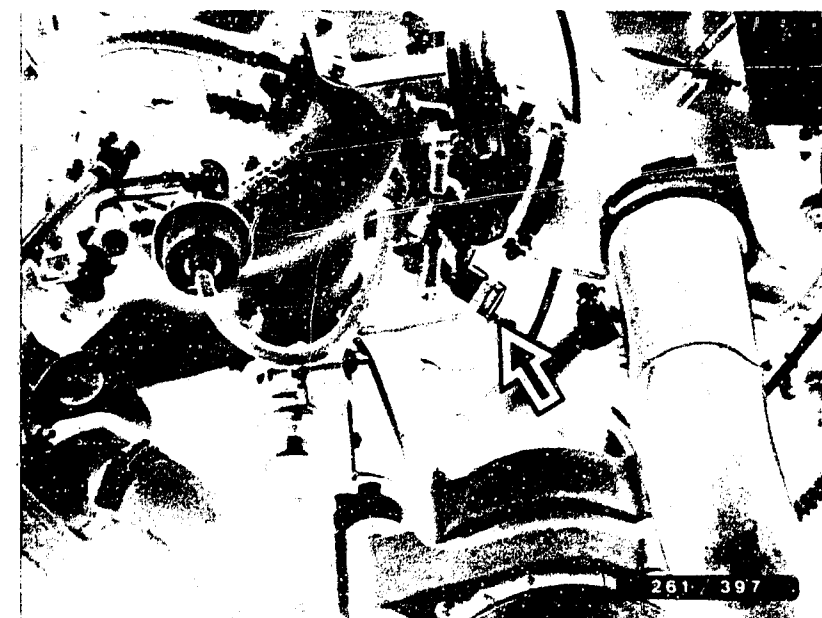
#### Test step 36 Connect motortester and CO analyzer

<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position</u> "V"	17	1. With engine at op. temp. and with air conditioner off:  <u>Idle speed:</u> 900 min <sup>-1</sup>  <u>CO checking value:</u> 0,5 ... 2,0 % CO <u>CO setting value:</u> 1,0 % CO  2. Press button T2: Values must not change.  If reading O.K., continue testing with next test step.	<u>Component:</u>  Engine, leaks in air-intake system Idle speed and CO adjustment
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment:</u> Motortester and CO analyzer			
<u>Measuring range:</u> Engine speed and CO			
<u>Connection:</u> Ignition coil, exhaust			
<u>Operation in vehicle:</u> Let engine run at operating temperature and switch off air conditioner (if fitted)			
			<u>Operation:</u>  Idle speed and exhaust
			<u>Malfunction:</u>  Readings outside tolerance

#### Trouble-shooting:

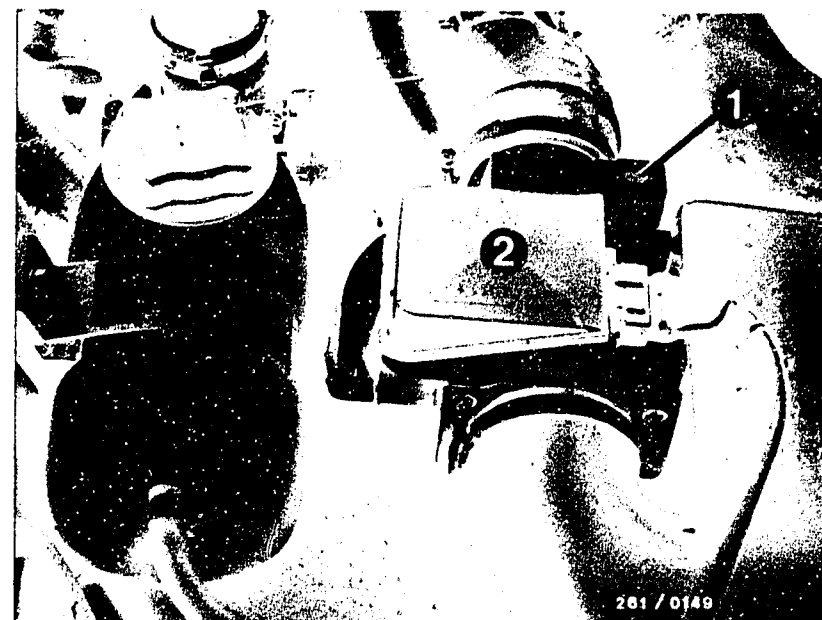
- Adjust idle speed at idle-speed-adjusting screw in throttle-valve assembly.

Continued on F15/F16



Arrow = Idle-speed adjusting screw

1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I



**F13**

Test with universal test adapter  
Volvo 740/760 Turbo



**F14**

Test with universal test adapter  
Volvo 740/760 Turbo



Trouble-shooting - TEST STEP 36 (continued)

- Adjust exhaust gas with idle-mixture-adjusting screw in air-flow sensor.

To do this, remove the plug in the air-flow sensor. After finishing the adjustment, use a new plug (red).

Turning the idle-mixture-adjusting screw in a clockwise direction:  
Increases the CO concentration.

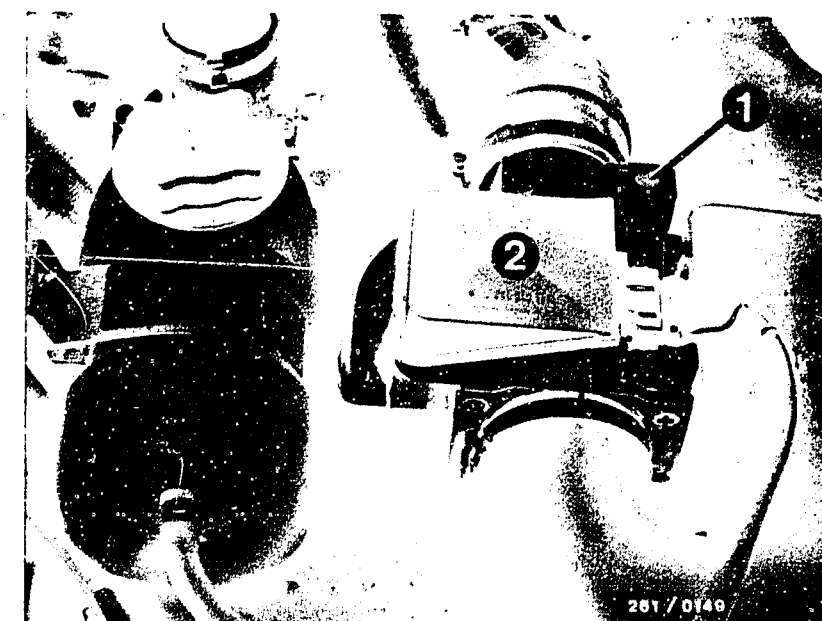
Turning the idle-mixture-adjusting screw in a counterclockwise direction:  
Reduces the CO concentration.

CO concentration less than 0,5 % by vol. CO and not adjustable:

Check intake side and exhaust system for leaks (fresh air) by means of pressure test.

Concerning 2.

If the readings change after pressing button T2, the engine is not yet at normal operating temperature.



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

**F15**

Test with universal test adapter  
Volvo 740/760 Turbo



**F16**

Test with universal test adapter  
Volvo 740/760 Turbo



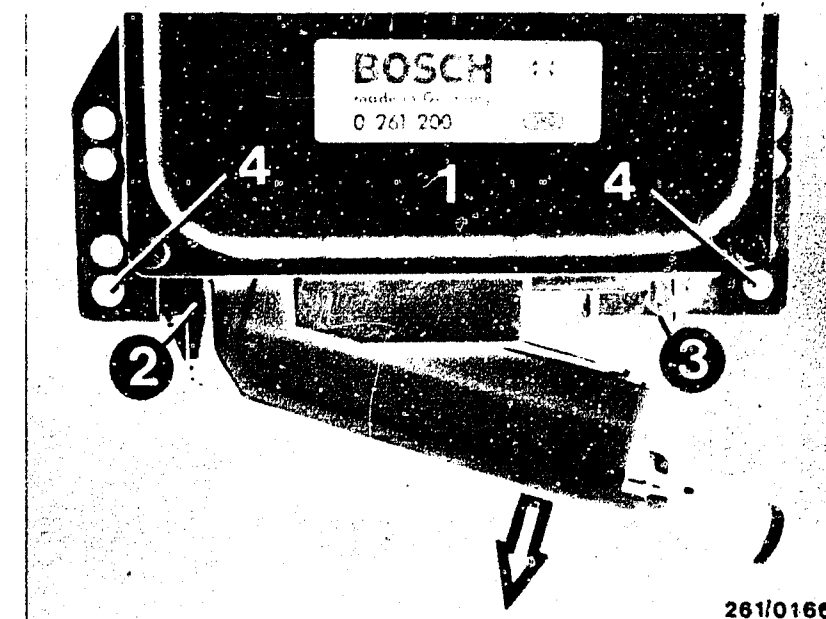
<u>Test step 37</u>			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position "V"</u>	17	1. Spark advance with engine at op. temp. and at idle speed: <u>5° ... 15°</u>	<u>Component:</u>  Control unit
<u>Program switch position "Ω"</u>	15		<u>Operation:</u>  Spark-advance angle at idle speed
<u>Measuring equipment:</u> Motortester			
<u>Measuring range:</u> Spark advance			
<u>Connection:</u> Timing light			
<u>Operation in vehicle:</u> Allow engine to reach operating temperature.			
		If reading O.K., continue testing with <u>next test step</u>	

#### Trouble-shooting:

- Re 1.: Check idle speed once again precisely, and repeat test step. Idle speed must be 900 min<sup>-1</sup>, otherwise other spark-advance angles will be indicated.

#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

Arrow =  
Moving mark on pulley and fixed  
degrees scale on plastic part



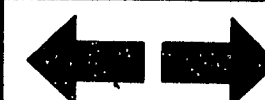
**F17**

Test with universal test adapter  
Volvo 740/760 Turbo

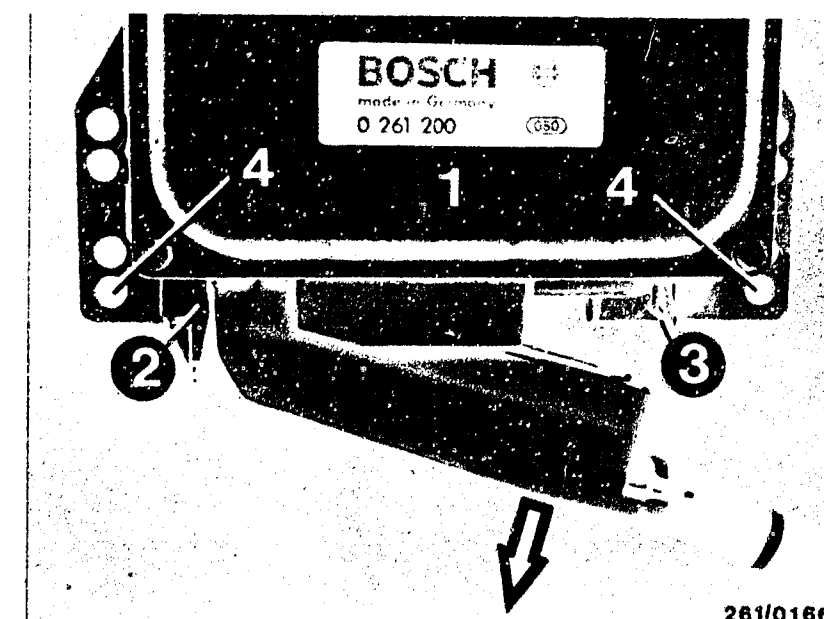


**F18**

Test with universal test adapter  
Volvo 740/760 Turbo



Test step 38			
Operation		Reading	Testing
Program switch position "V"	17	1. With engine at normal operating temperature and at idle speed:  <u>8...15°</u>  2. At 3000 min <sup>-1</sup>  <u>30°...45°</u>   If reading O.K., continue testing with next test step	Component:  Control unit
Program switch position "Ω"	15		
Measuring equipment: Motortester			Operation:  Dwell angle
Measuring range: Dwell angle			
Connection: Ignition coil			Malfuction:  Dwell angle outside tolerance
Operation in vehicle:  Let engine run			



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

#### Trouble-shooting:

Replace control unit

#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.

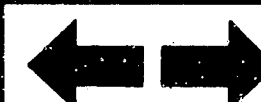
**F19**

Test with universal test adapter  
Volvo 740/760 Turbo



**F20**

Test with universal test adapter  
Volvo 740/760 Turbo





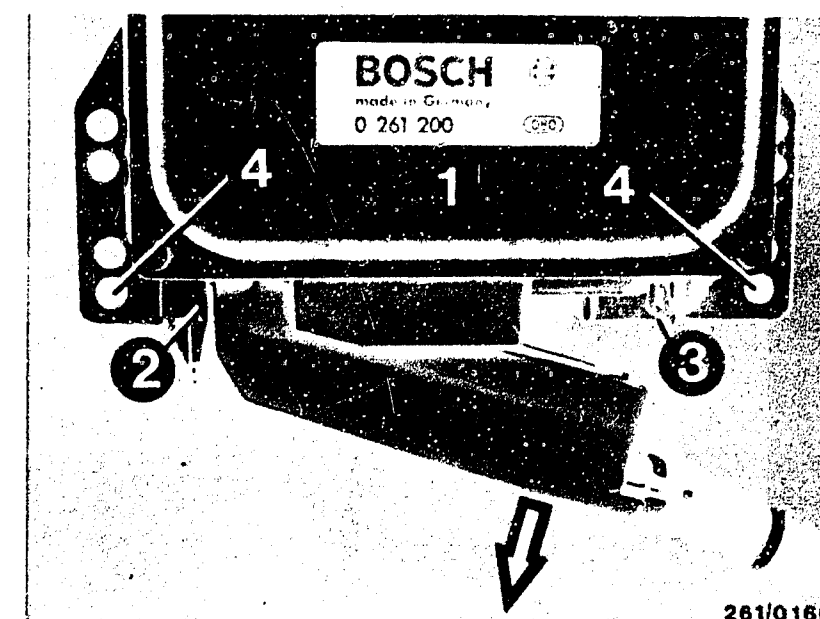
Test step 39			
Operation		Reading	Testing
Program switch position "V"	17	Engine at normal operating temperature Engine speed 2000 min <sup>-1</sup> (keep accelerator in same position). Press button T5:  <u>Engine "hunts"</u> i.e. engine speed drops (dependent on engine temperature) to 900 ... 1200 min <sup>-1</sup> . Then engine speed rises again and then drops again, and so on.	Component:  Control unit
Program switch position "Ω"	15		
Measuring equipment: Motortester			Operation:  Cutting off of injection pulses (overrun cutoff)
Measuring range: Engine speed			Malfunction:  No cutoff
Connection: Ignition coil			
Operation in vehicle: Let engine run			
Button: Press T5			

#### Trouble-shooting:

#### Replace control unit

#### Note:

To rule out confusion between the control units of the various systems, a mechanical locking system has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting holes

**F21**

Test with universal test adapter  
Volvo 740/760 Turbo



**F22**

Test with universal test adapter  
Volvo 740/760 Turbo



Testing with the Universal test adapter is now completed.  
If the fault has not been found or if you require  
further information and instructions on how to remedy  
the fault, continue with the trouble-shooting program  
of your choice.

Detailed trouble-shooting → see C3/C4  
Direct trouble-shooting → see C5...C10



# STARTING MOTOR OPERATES, ENGINE FAILS TO START OF STARTS ONLY WITH GREAT DIFFICULTY

## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

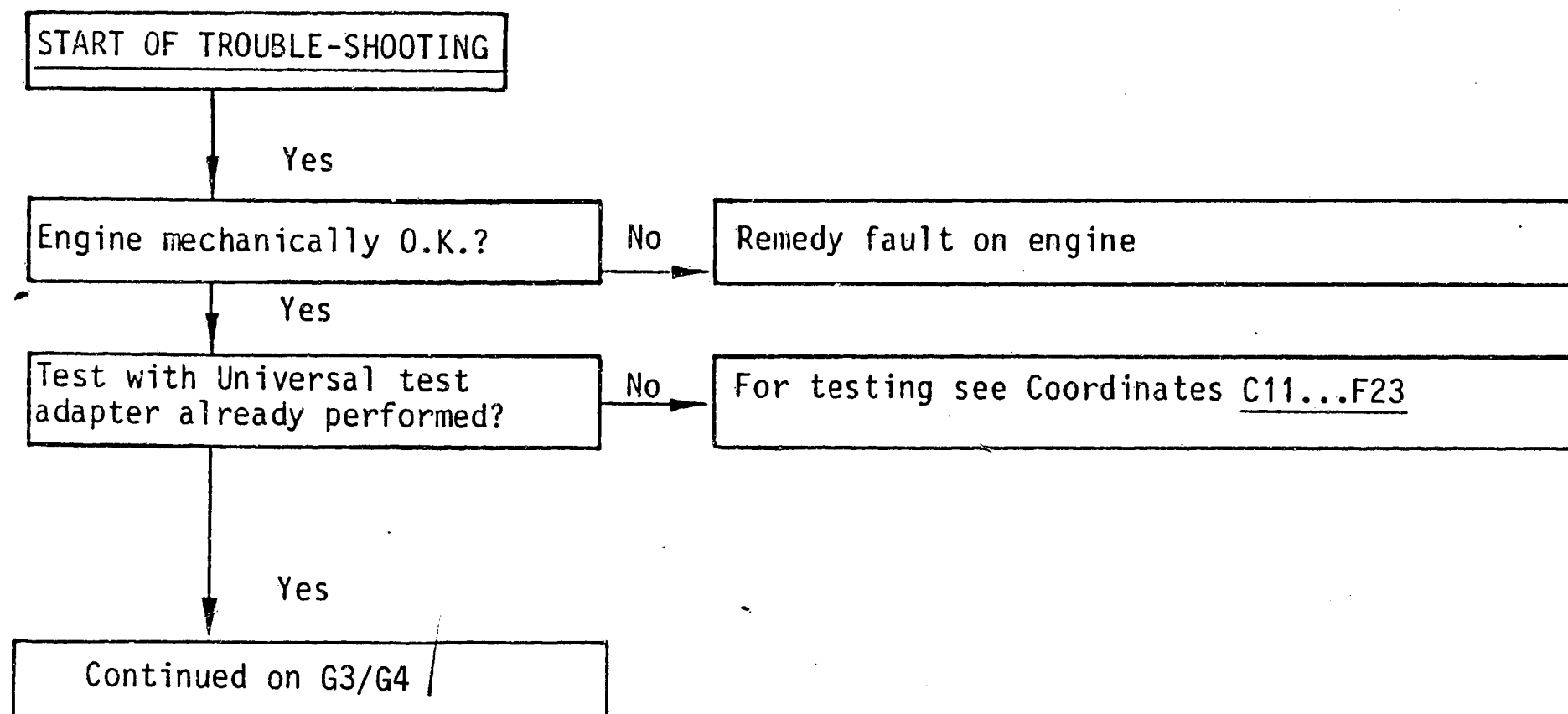
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**G1**

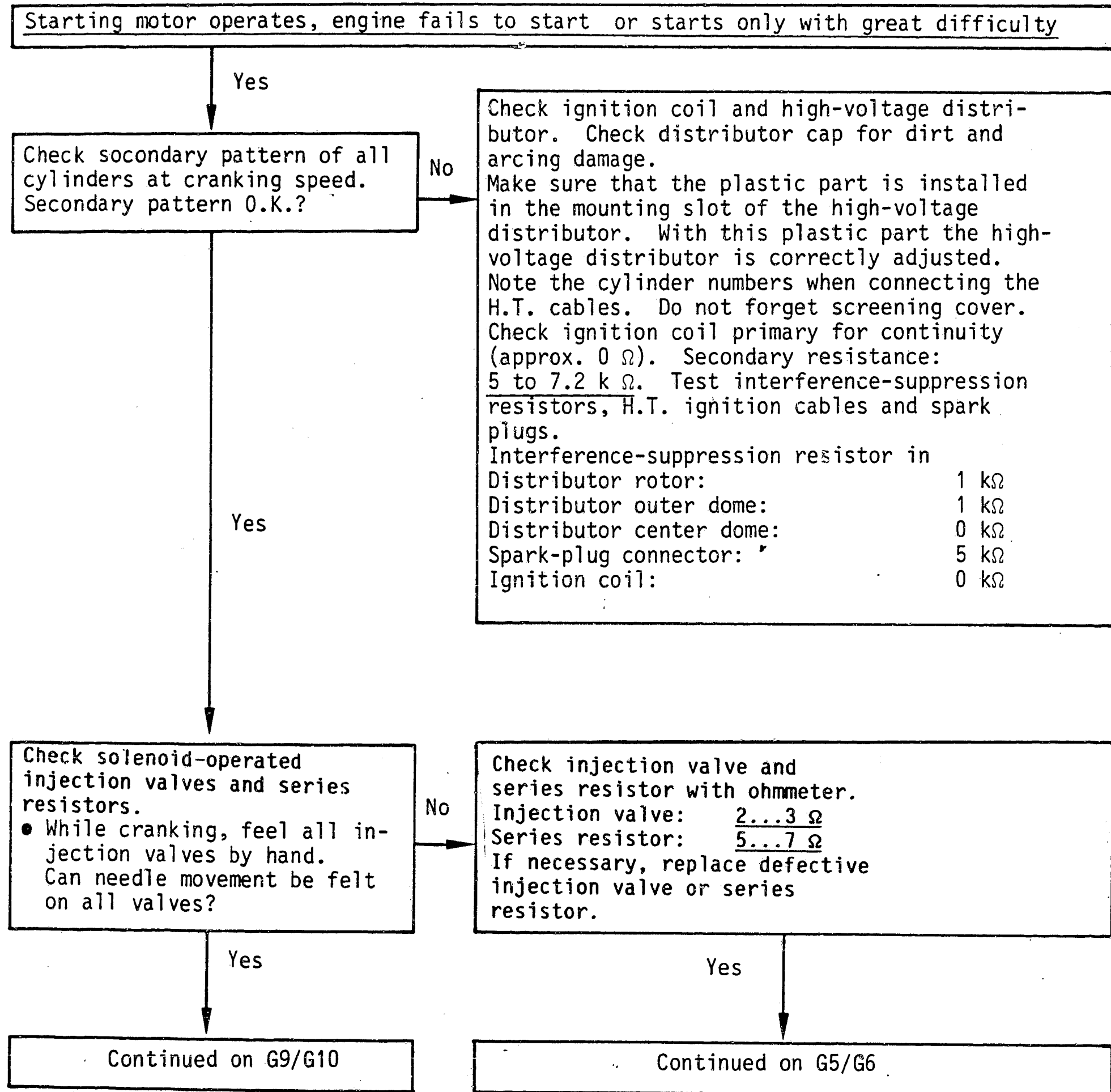
Engine fails to start  
Volvo 740/760 Turbo



**G2**

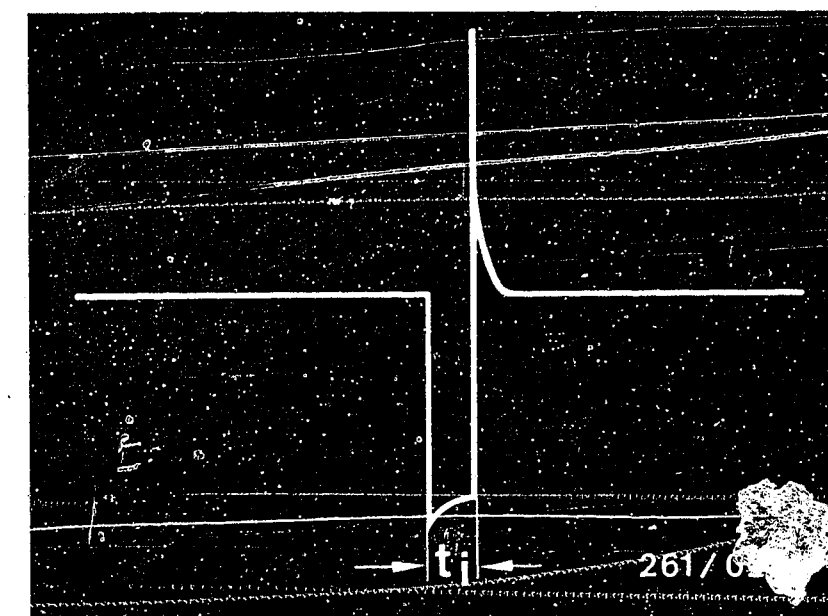
Engine fails to start  
Volvo 740/760 Turbo





1 = Ignition coil.  
2 = High-voltage distributor

Injection signal at injection valve  
 $t_i$  = Duration of injection



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

### Removing the solenoid-operated injection valves

Loosen the fastening screws on the fuel-distribution pipe. Pull the fuel-distribution pipe upward until the injection valves are out of the bore in the intake manifold. Do not damage the nozzle needle or rubber seal.

Check the nozzle needle and surrounding area for leaks and deposits.

Remove the electrical connector.

Carefully slide the holding clamps out of the groove and pull the injection valve out of the fuel distribution pipe connection.

Caution: Catch escaping fuel. Do not allow to drip onto hot parts of the engine.

### Installing the injection valves

Replace O-rings if damaged, brittle or swollen. Do not remove protection sleeve. When replacing O-ring for intake port seal, cut O-ring and fit new O-ring over protection sleeve and bead. Do not damage any parts. Use parts set 1 287 010 704. Grease O-rings only lightly with Ft2v2 (Wacker silicone grease 300 medium). The other valve parts must remain free of grease. When working on injection valves, do not damage the nozzle needle.

Yes

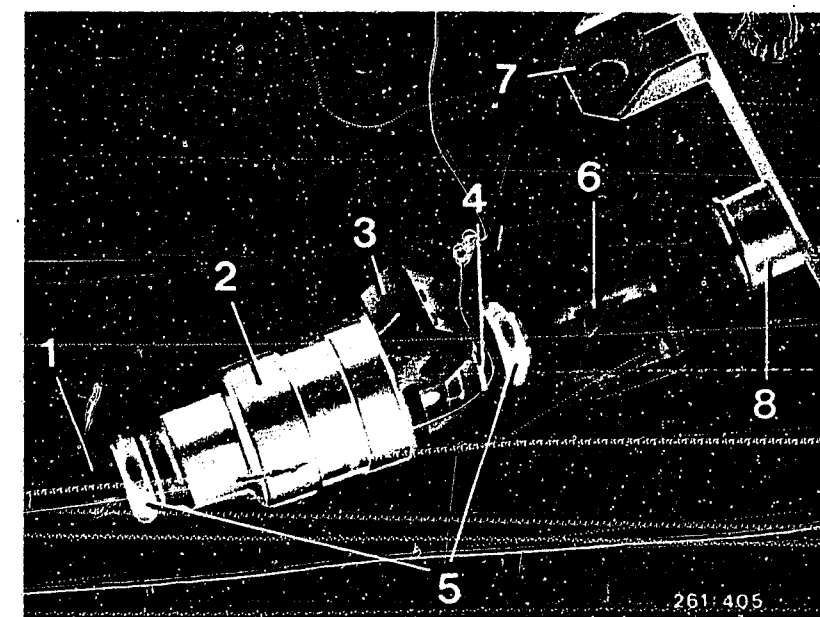
Continued on G9/G10

Continued on G7/G8



Arrow = Series resistors for injection valves

- 1 = Protective sleeve
- 2 = Injection valve
- 3 = Electrical connection
- 4 = Groove
- 5 = Rubber seal
- 6 = Holding clamp
- 7 = Mounting bracket
- 8 = Fuel-distribution pipe connection



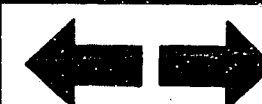
**G5**

Engine fails to start  
Volvo 740/760 Turbo



**G6**

Engine fails to start  
Volvo 740/760 Turbo



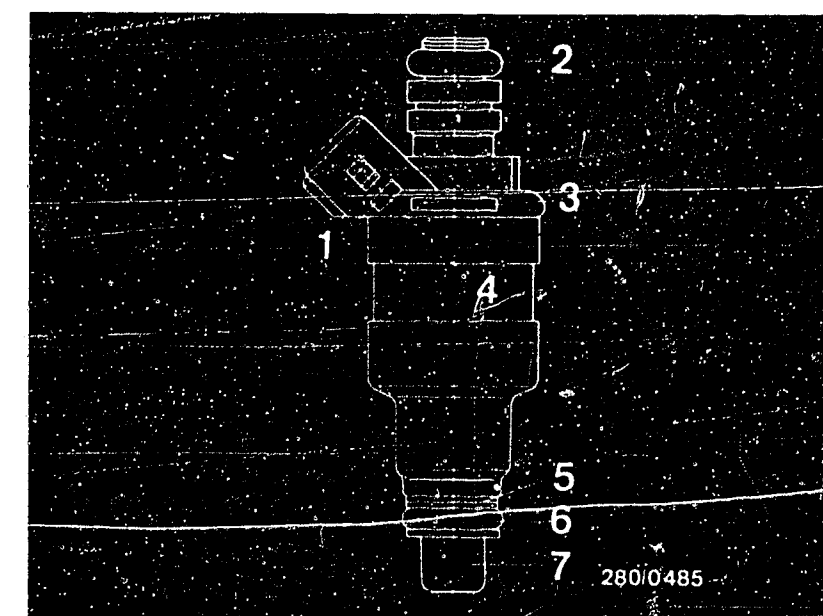
Starting motor operates, engine fails to start or starts only with great difficulty (continued)

Check both rubber seals for correct seating before installing. Press all 4 injection valves uniformly into their seats with the fuel-distribution pipe. Screw down fuel-distribution pipe. Check all air and fuel hoses for correct seating. Make electrical connections.

Start engine and check whether any unmetered air is being drawn in.

Yes

Continued on G9/G10



- 1 = FD mark
- 2 = Upper O-ring
- 3 = Part number
- 4 = Injection valve
- 5 = Supporting plate
- 6 = Lower O-ring
- 7 = Protection sleeve

**G7**

Engine fails to start  
Volvo 740/760 Turbo



**G8**

Engine fails to start  
Volvo 740/760 Turbo



Starting motor operates, engine fails to start or starts only with difficulty (continued)

yes

Time-delay relay O.K.?  
(Injection valve of cylinder 2  
not clicking)

no

Operation of time-delay relay:  
If the overdrive is operated in 4th gear  
under load, the time-delay relay pulls in for  
approx. 0.3 seconds.  
The injection valve of cylinder 2 is then  
switched off for this period via the  
injection output stage in order to reduce the  
engine torque and to permit smooth, gentle  
shifting into overdrive.  
Testing: Disconnect time-delay relay. If  
injection valve of cylinder 2 now operates,  
replace time-delay relay and check the  
associated components and leads according to  
circuit diagram.

yes

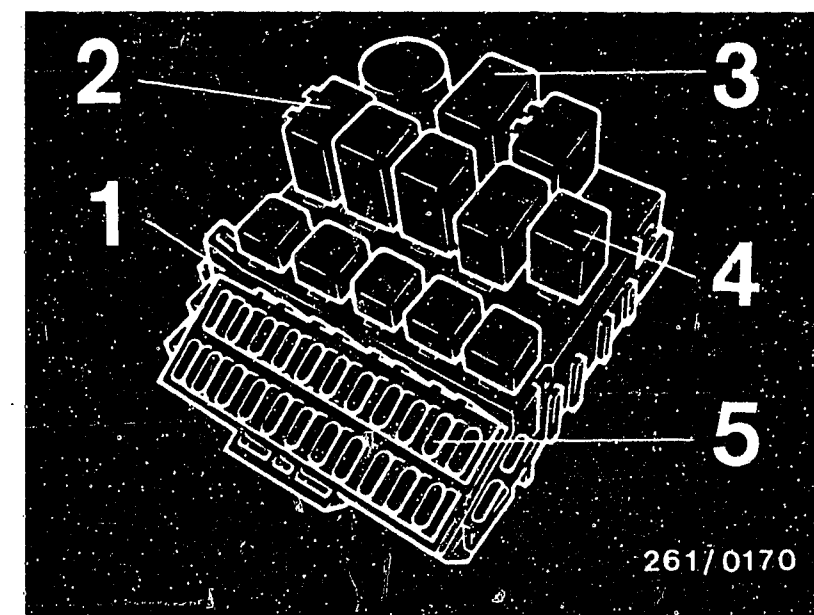
Injection output stage  
functioning?

no

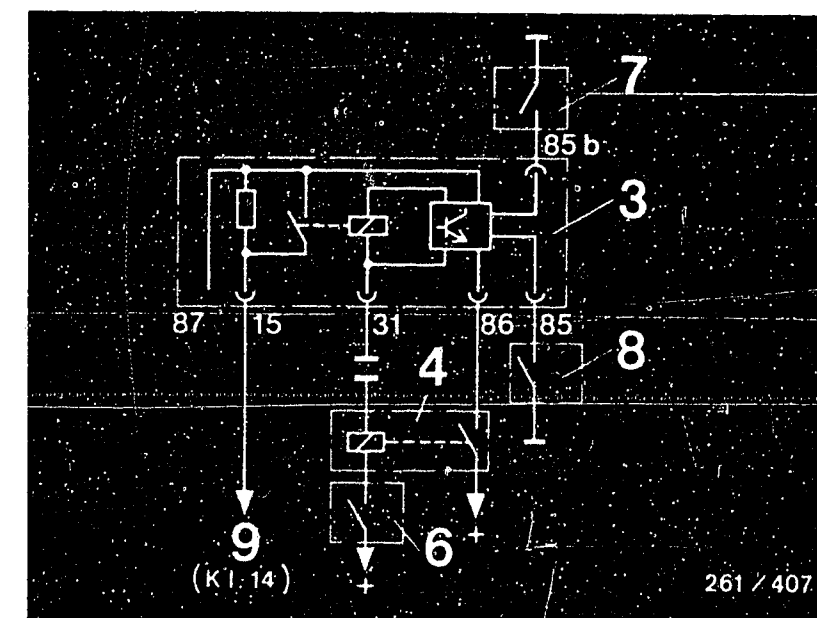
- Start engine and check injection pulses at solenoid-operated injection valves with oscilloscope (special input). (Use test lead 1 684 463 093)
- With ignition off, disconnect 25-pin plug to output stage and check the power supply (ignition on: 10...15V at term. 1/term. 8).
- Check lead from 25-pin plug (term. 16) to Motronic multiple plug (term. 14) as well as leads to solenoid-operated injection valves (approx. 0  $\Omega$ ).
- Switch off ignition. Disconnect the ETC control unit and check injection pulses again with oscilloscope. If injection output stage functions only with ETC control unit disconnected, this points to a fault in the ETC system; otherwise replace output stage.

yes

Continued on G11/G12



- 1 = Central-electrics box
- 2 = Relay set
- 3 = Time-delay relay
- 4 = Switching relay for overdrive (OD)
- 5 = Fuses
- 6 = Actuating switch for OD
- 7 = Charge-air pressure switch
- 8 = Hydraulic pressure switch on transmission
- 9 = To injection output stage (term. 14)



G9

Engine fails to start  
Volvo 740/760 Turbo



G10

Engine fails to start  
Volvo 740/760 Turbo



Starting motor operates, engine fails to start or starts only with difficulty (contin.)

yes

Idle-speed control O.K.?

no

- Push back protective rubber cap on plug to idle actuator and, using test prods with plug connected, check the voltage at term. 3 and 5 to term. 4 with oscilloscope (bottom diagram). If no pulses, check leads to idle controller (terminals 3, 4, 5).  
Record on/off ratio at idle actuator at 900 min<sup>-1</sup> with dwell-angle tester, term. 3/4: 67...77%, term. 5/4: 23...33% (engine at operating temperature, switch off electrical devices).
- Measure winding resistance of actuator (at +15°C ...+30°C); term. 3/4: 19...25 Ω; term. 5/4: 17...22.5 Ω (to do this, disconnect plug).
- Further trouble-shooting: actuator mechanically defective, e.g. slide stiff.

Idle controller O.K.?

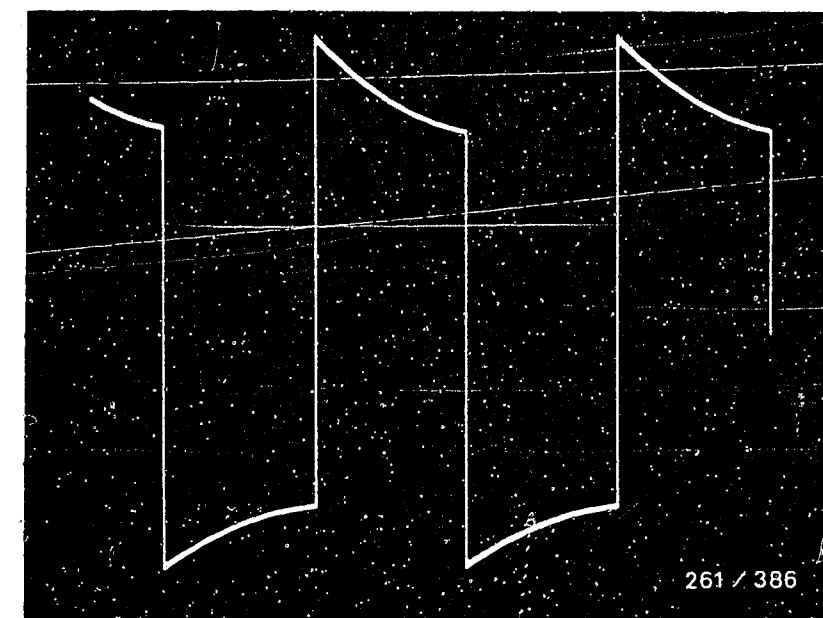
- Dwell-period signal present at term. 12 of controller?  
Measurement with controller connected, directly at rear on plug (engine idling).
- Power supply (10...15 V) at term. 1/2.  
Switch on ignition.
- Idle contact closing with throttle valve closed?  
- Approx. 0 V then at term. 8?
- Check double temperature sensor (NTC II).  
Switch off ignition and disconnect plug to controller.  
Measure resistance between term. 9 in plug and vehicle ground.  
At +15°C...+30°C: 1.45...3.3 kΩ  
+80°C: 280...360 Ω
- With air conditioner off, there must be no battery voltage at term. 7.

yes

Continued on G13/G14



Arrow = Idle actuator



**G11**

Engine fails to start  
Volvo 740/760 Turbo

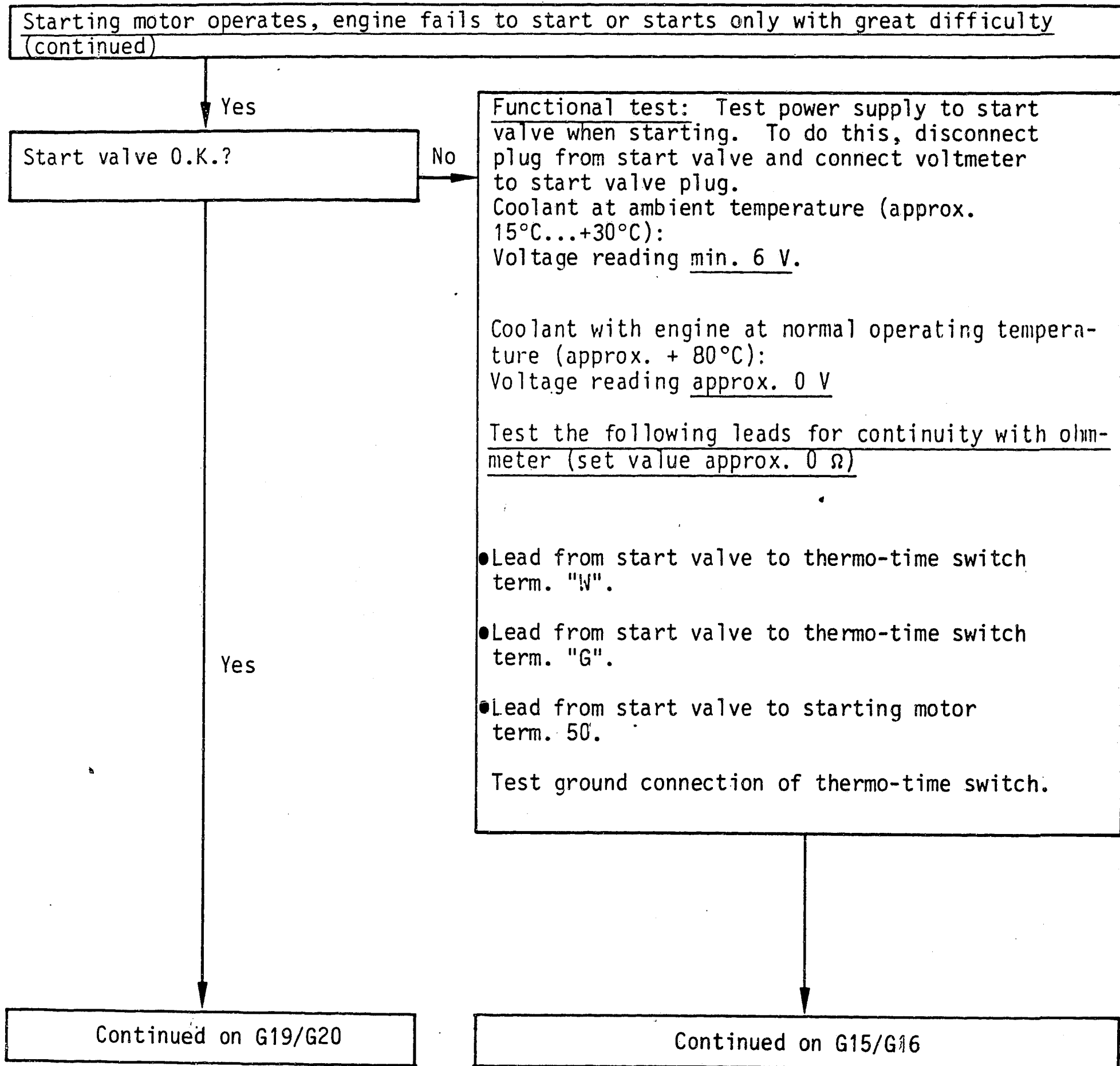


**G12**

Engine fails to start  
Volvo 740/760 Turbo

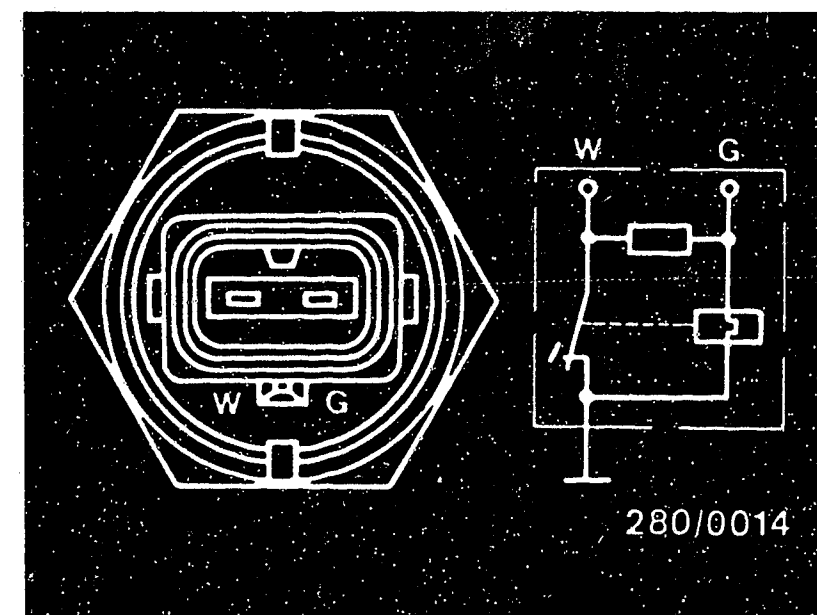






Arrow = Start valve  
(at bottom on intake manifold)

Thermo-time switch



Starting motor operates, engine fails to start or starts only with great difficulty  
(Continued)

Electric test of start valve:  
Connect ohmmeter to start valve (remove plug):  
Set value approx.  $4\ \Omega$ .  
Mechanical test of start valve:  
Remove start valve from intake manifold and  
hold in a container. (Caution! Fire hazard!).  
When starting at temperatures below ambient  
temperature (approx.  $+15^{\circ}\dots 30^{\circ}\text{C}$ ) the start  
valve must squirt (max. 7,5 sec). With the  
engine at normal operating temperature (approx.  
 $+80^{\circ}\text{C}$ ) the start valve must not squirt. With  
the ignition switched on and the pressure  
built up the start valve must likewise not  
squirt.

Yes

Continued on G19/G20

Continued on G17/G18



Arrow = Start valve  
(at bottom on intake  
manifold)

**G 15**

Engine fails to start  
Volvo 740/760 Turbo



**G 16**

Engine fails to start  
Volvo 740/760 Turbo



Starting motor operates, engine fails to start or starts only with great difficulty  
(Continued)

Carry out squirt test for engine at normal operating temperature (approx. + 80°C) as follows:  
Remove plug from thermo-time switch and ground term. W.

Testing the start valve for leaks:

1. When installed

Switch over directional-control valve of pressure tester so that start valve is shut off from fuel-distribution pipe. If engine now starts, replace start valve.

2. When removed

Remove start valve (Caution! Fire hazard!)  
Fuel line and electric lead remain connected (place collector vessel under the start valve).

Build up fuel pressure:

On the universal test adapter set the program switch "V" to position 17. Switch on the ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on G19/G20 |



Arrow = Start valve  
(at bottom on intake manifold)

**G17**

Engine fails to start  
Volvo 740/760 Turbo



**G18**

Engine fails to start  
Volvo 740/760 Turbo



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

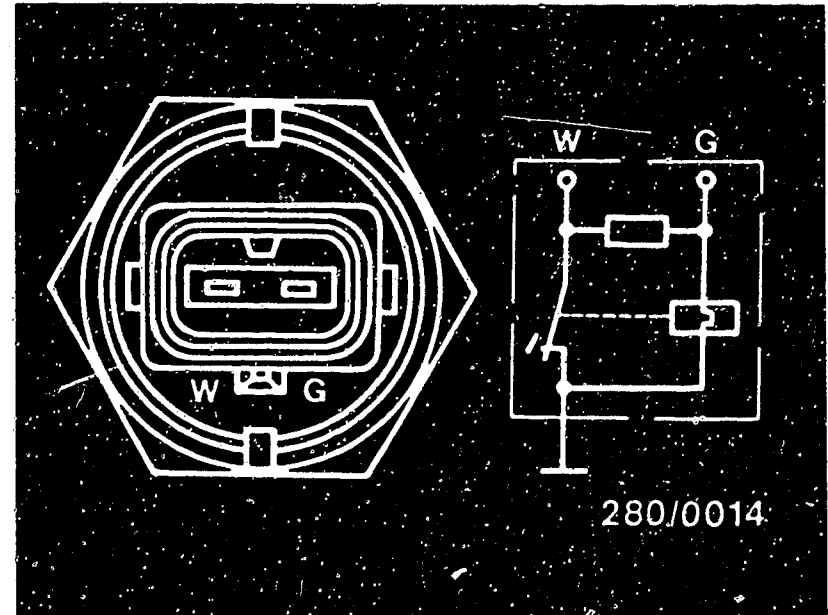
Thermo-time switch  
O.K.?

No

Electrical test Test thermo-time switch 35°/7,5 sec. as follows: Remove plug and make direct resistance measurement at thermo-time switch using ohmmeter.			
	Between term. "G" + ground	Between term. "W" + ground	Between term. "G" + "W"
Ambient temperature (below 30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at normal operating temperature (above 40°C)	50...80 Ω	100...160 Ω	50...80 Ω

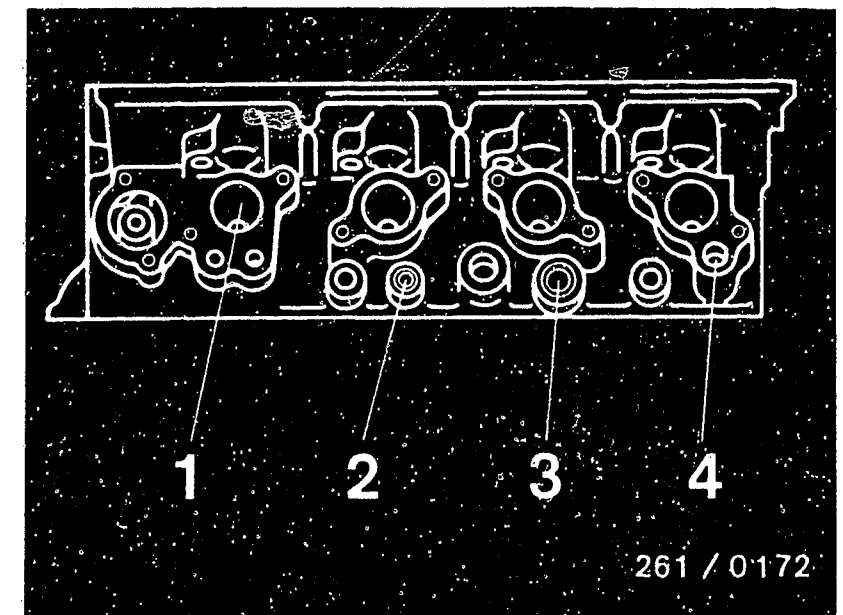
Yes

Continued on G21/G22



Thermo-time switch

- 1 = Cylinder 1 (intake manifold removed)
- 2 = Sensor for indication in instrument panel
- 3 = Engine temperature sensor (NTC II)
- 4 = Thermo-time switch



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Air-flow sensor mechanically  
O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

Are all hose lines and electric  
leads securely attached?  
Visual examination.  
Is the air-intake system leak-  
tight?

No

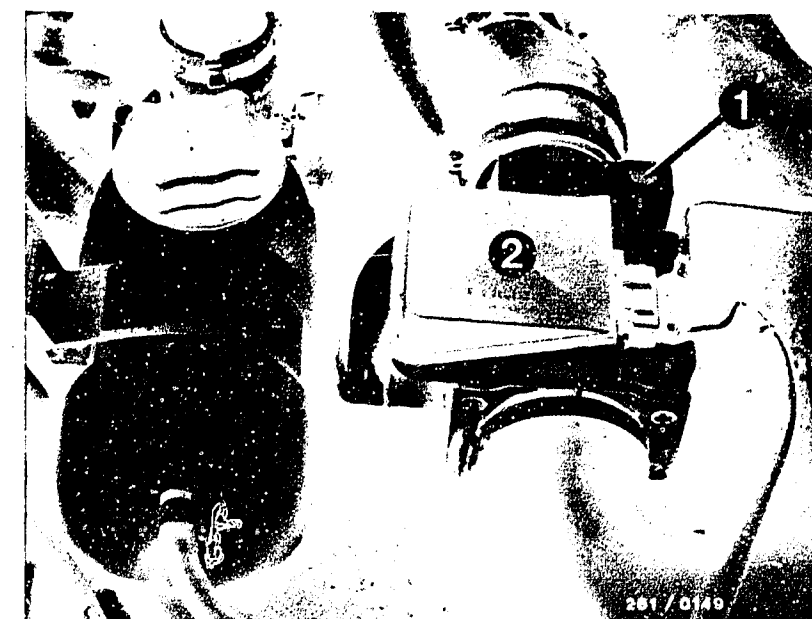
Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

Yes

Continued on G23/G24



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with  
NTC I

Arrow = Idle actuator



**G21**

Engine fails to start  
Volvo 740/760 Turbo



**G22**

Engine fails to start  
Volvo 740/760 Turbo



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Testing completed for customer complaint

"Starting motor operates, engine fails to start or starts only with great difficulty",

Customer complaint remedied?

No

Further possibilities

- Customer complaint incorrectly diagnosed (see Coordinates C3...C10). If the fault has not be detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**G23**

Engine starts but then dies

Volvo 740/760 Turbo



**G24**

Engine starts but then dies

Volvo 740/760 Turbo



## ENGINE STARTS BUT THEN DIES

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

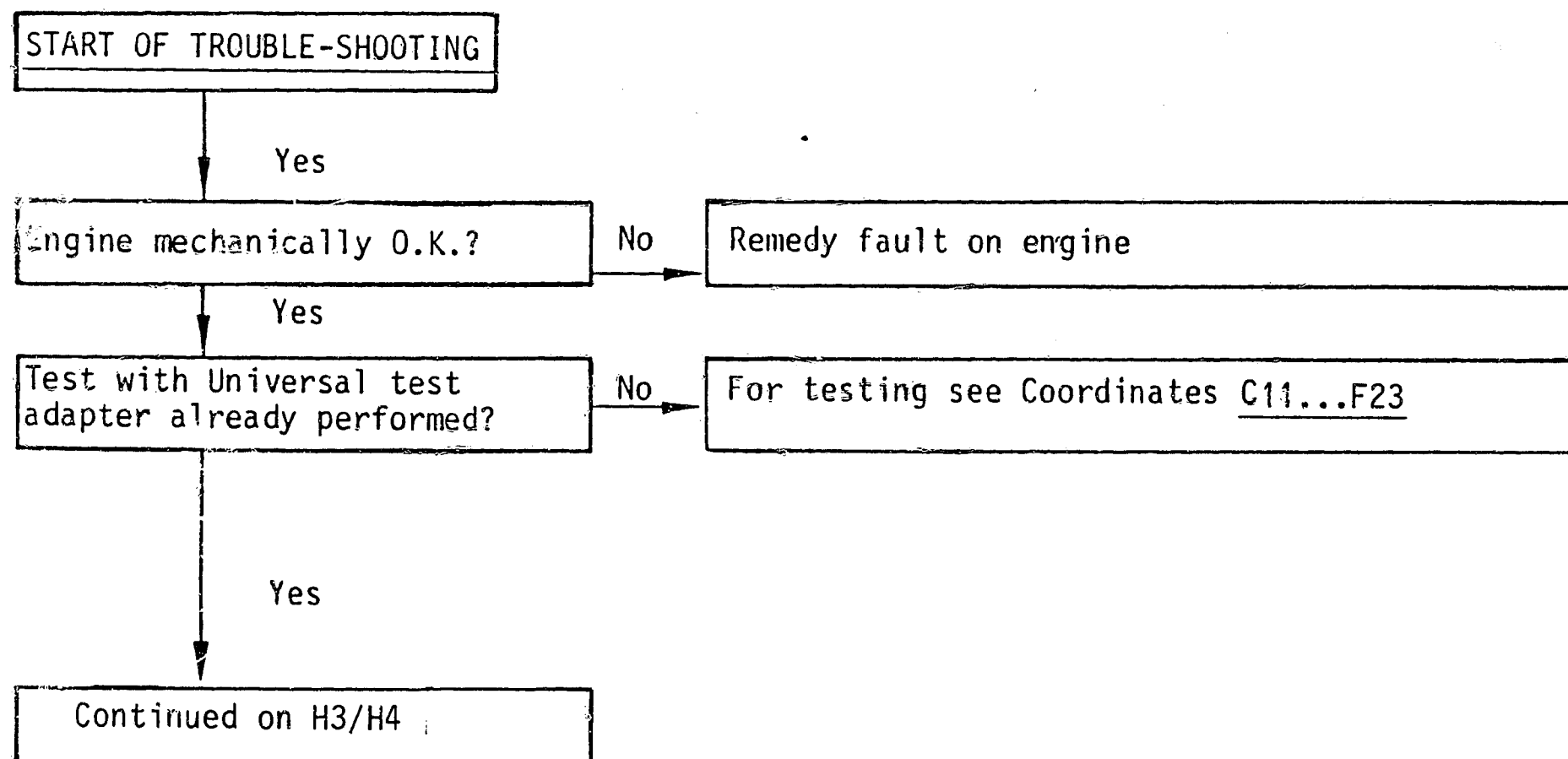
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**H1**

Engine starts but then dies  
Volvo 740/760 Turbo



**H2**

Engine starts but then dies  
Volvo 740/760 Turbo



Engine starts but then dies (continued)

yes

Are all hose lines and electric leads securely attached? Visual examination. Is the air-intake system leak-tight?

no

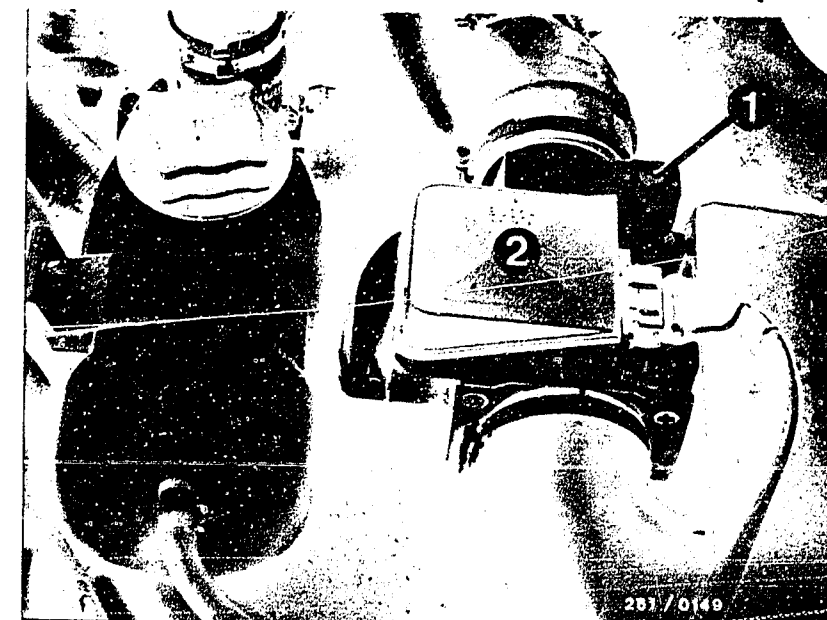
Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

yes

Continued on H5/H6



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor

Arrow = Idle actuator



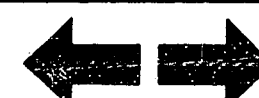
**H3**

Engine starts but then dies  
Volvo 740/760 Turbo



**H4**

Engine starts but then dies  
Volvo 740/760 Turbo





Engine starts but then dies (continued)

yes

Idle-speed control O.K.?

no

- Push back protective rubber cap on plug to idle actuator and, using test prods with plug connected, check the voltage at term. 3 and 5 to term. 4 with oscilloscope (bottom diagram). If no pulses, check leads to idle controller (terminals 3, 4, 5).  
Record on/off ratio at idle actuator at 900 min<sup>-1</sup> with dwell-angle tester, term. 3/4: 67...77%, term. 5/4: 23...33% (engine at operating temperature, switch off electrical devices).
- Measure winding resistance of actuator (at +15°C ...+30°C); term. 3/4: 19...25 Ω; term. 5/4: 17...22.5 Ω (to do this, disconnect plug).
- Further trouble-shooting: actuator mechanically defective, e.g. slide stiff.

Idle controller O.K.?

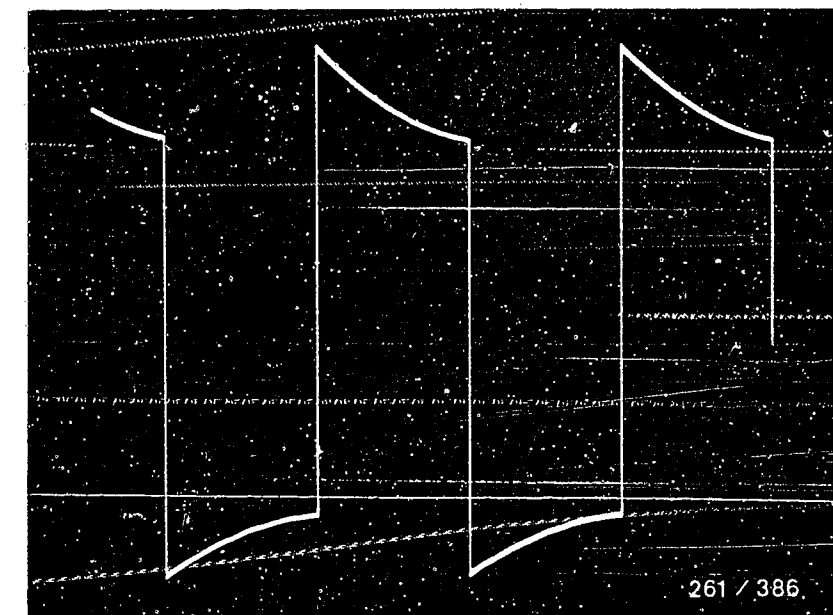
- Dwell-period signal present at term. 12 of controller?  
Measurement with controller connected, directly at rear on plug (engine idling).
- Power supply (10...15 V) at term. 1/2.  
Switch on ignition.
- Idle contact closing with throttle valve closed?  
- Approx. 0 V then at term. 8?
- Check double temperature sensor (NTC II).  
Switch off ignition and disconnect plug to controller.  
Measure resistance between term. 9 in plug and vehicle ground.  
At +15°C...+30°C: 1.45...3.3 kΩ  
+80°C: 280...360 Ω
- With air conditioner off, there must be no battery voltage at term. 7.

yes

Continued on H7/H8



Arrow = Idle actuator



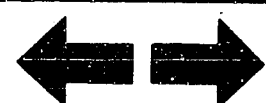
H5

Engine starts but then dies  
Volvo 740/760 Turbo



H6

Engine starts but then dies  
Volvo 740/760 Turbo



Engine starts but then dies (continued)

Start valve O.K.?  
(Leak test)

No

Testing the start valve for leaks:

1. When installed

Switch over directional-control valve of pressure tester so that start valve is shut off from fuel-distribution pipe. If engine now starts, replace start valve.

2. When removed

Remove start valve (caution - fire hazard). Fuel line and electric lead remain connected (place collector vessel under start valve).

Build up fuel pressure:

On universal test adapter set program switch "V" to position 17.

Switch on ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on H9/H10



Arrow = Start valve  
(at bottom on intake manifold)

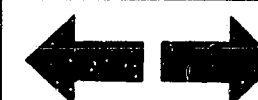
H7

Engine starts but then dies  
Volvo 740/760 Turbo



H8

Engine starts but then dies  
Volvo 740/760 Turbo



Engine starts but then dies (continued)

Thermo-time switch O.K.?

No

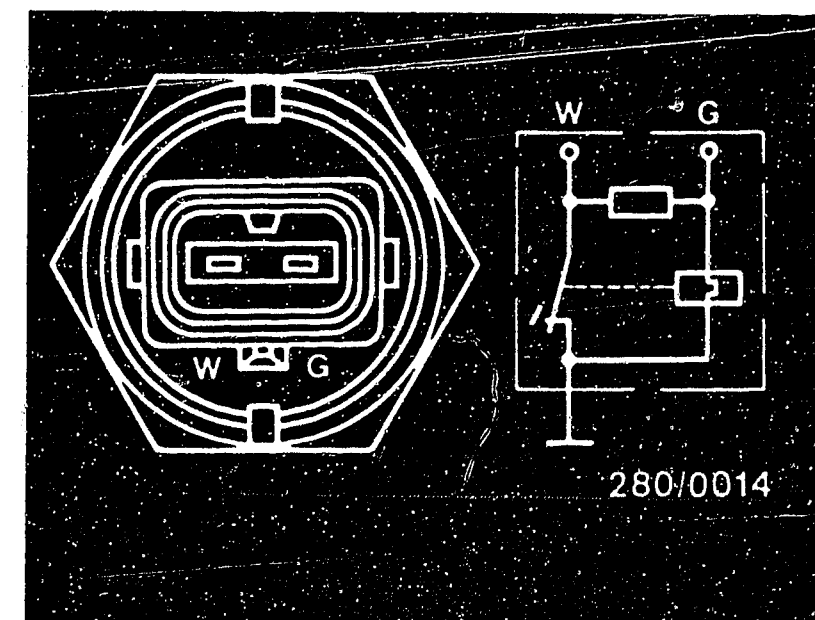
#### Electrical test

Test thermo-time switch 35°/7,5 sec. as follows:  
Remove plug and make direct resistance measurement  
at thermo-time switch using ohmmeter.

	Between term. "G" + ground	Between term. "W" + ground	Between term. "G" + "W"
Ambient temperature (below 30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at normal operating temperature (above 40°C)	50...80 Ω	100...160 Ω	50...80 Ω

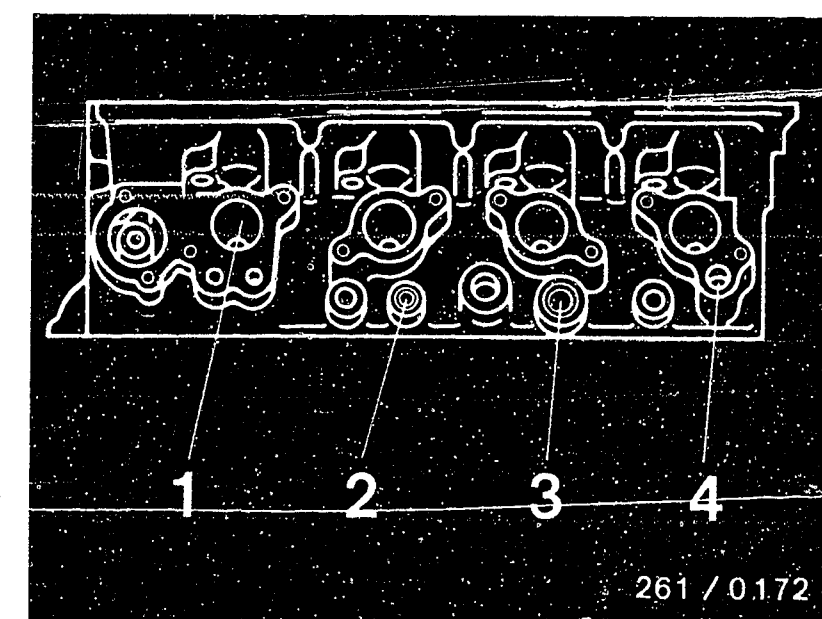
Yes

Continued on H11/H12



Thermo-time switch

- 1 = Cylinder 1 (intake manifold removed)
- 2 = Sensor for indication in instrument panel
- 3 = Engine temperature sensor (NTC II)
- 4 = Thermo-time switch



**H9**

Engine starts but then dies  
Volvo 740/760 Turbo



**H10**

Engine starts but then dies  
Volvo 740/760 Turbo



Engine starts but then dies (continued)

Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

Testing completed for customer complaint

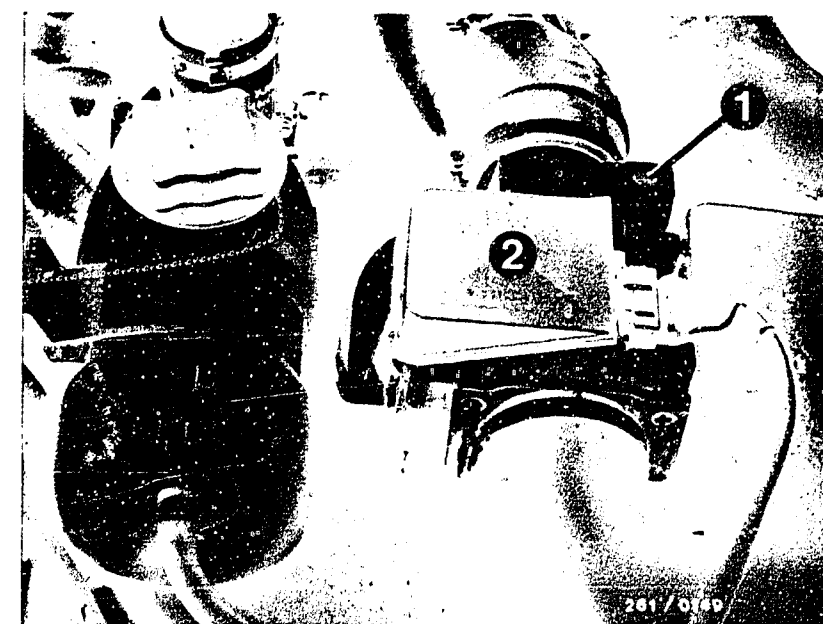
"Engine starts but then dies".

Customer complaint remedied?

No

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinate C3/C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

**H11**

Engine starts but then dies  
Volvo 740/760 Turbo



**H12**

Engine starts but then dies  
Volvo 740/760 Turbo



## UNEVEN ENGINE IDLE, SPEED ADJUSTMENT (IDLE) AND EXHAUST-GAS ADJUSTMENT (continued)

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

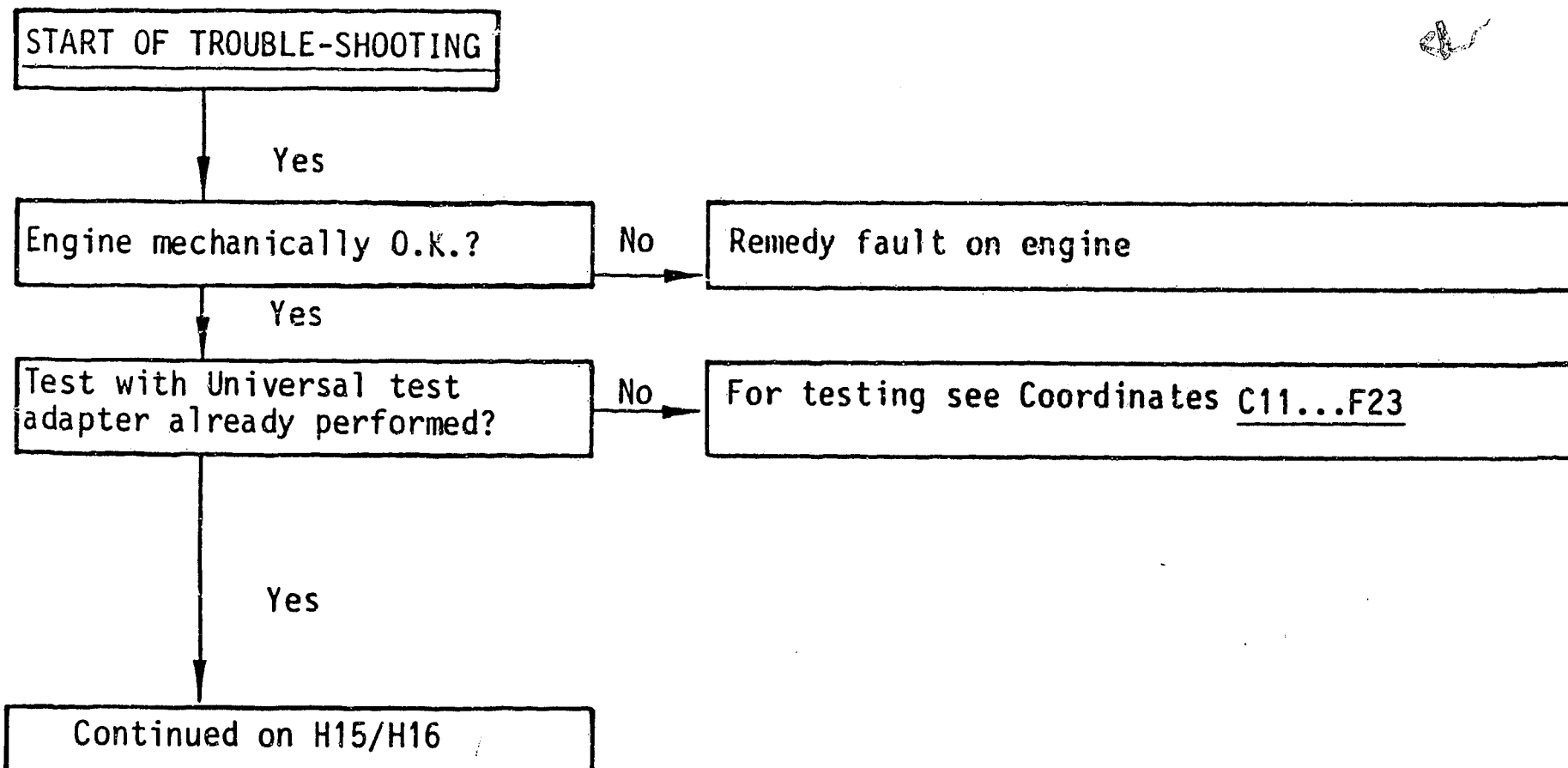
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**H13**

Uneven engine idle  
Volvo 740/760 Turbo

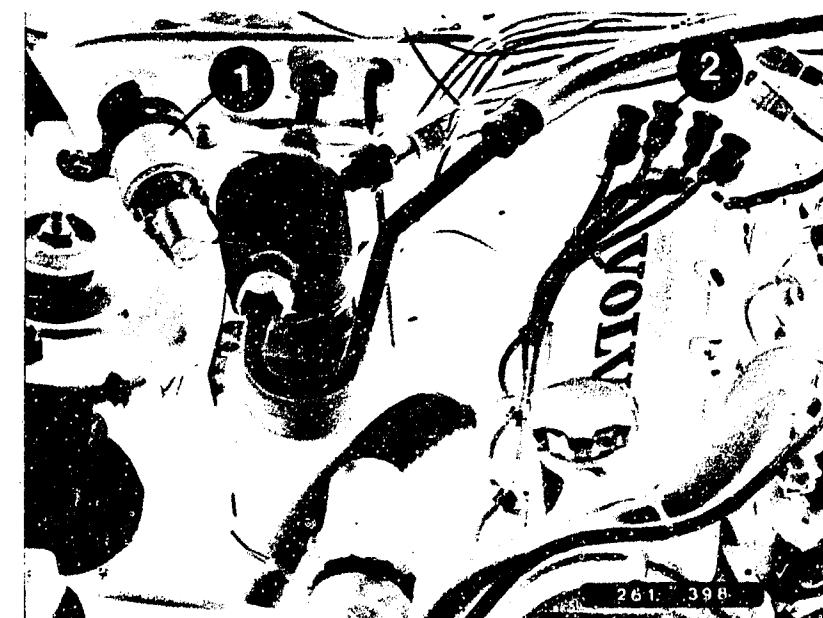
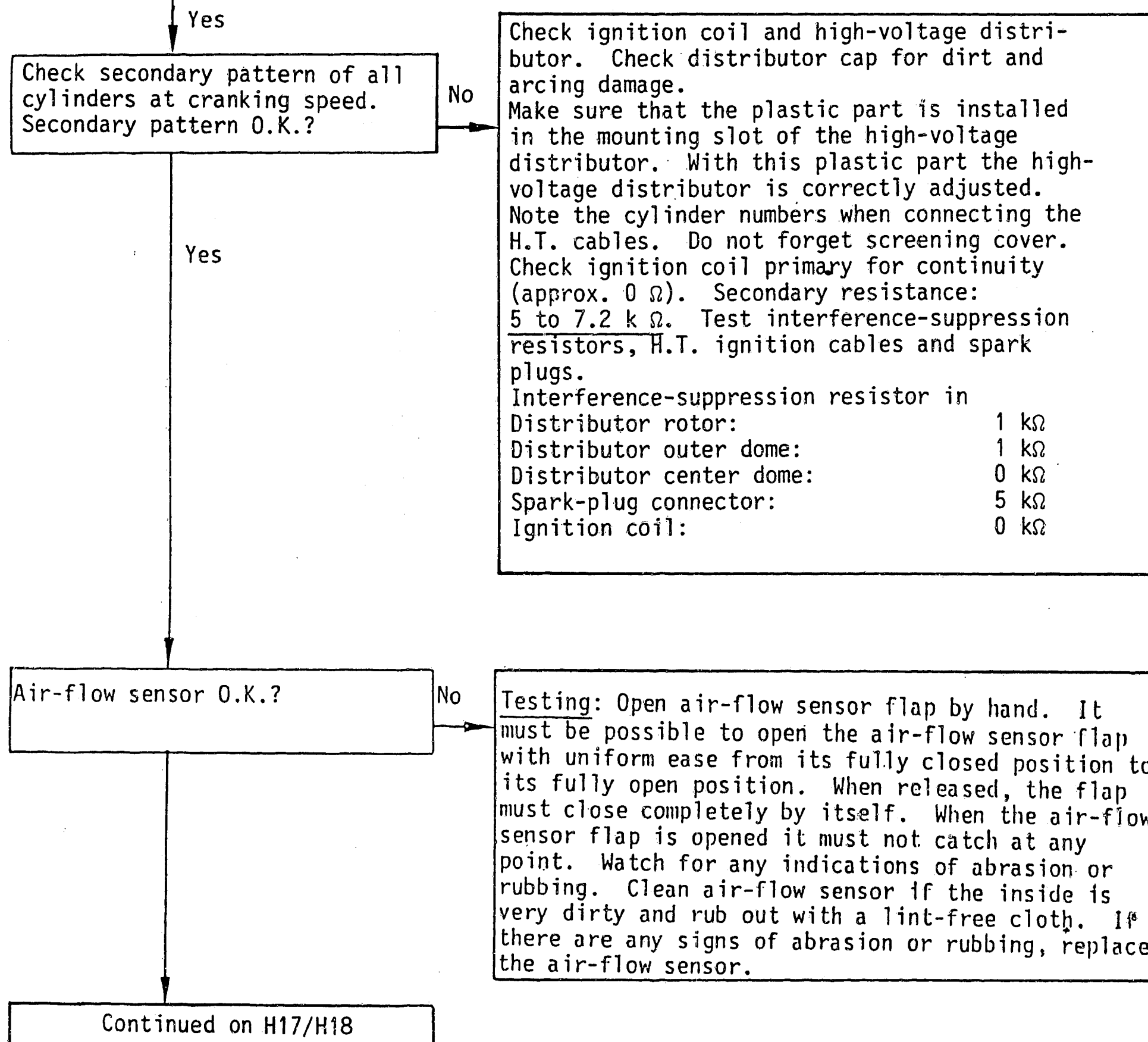


**H14**

Uneven engine idle  
Volvo 740/760 Turbo

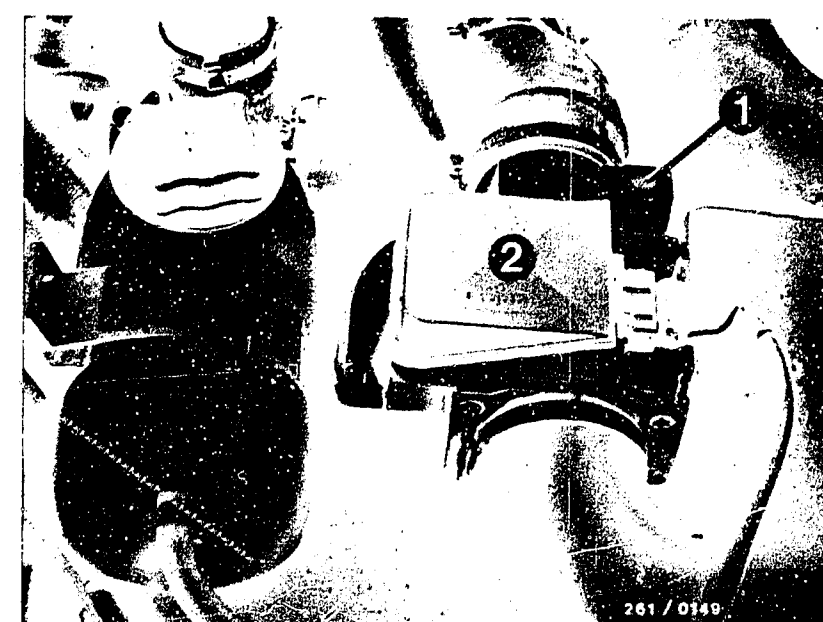


# Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)



1 = Ignition coil  
2 = High-voltage distributor

1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor



**H15**

Uneven engine idle  
Volvo 740/760 Turbo



**H16**

Uneven engine idle  
Volvo 740/760 Turbo



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

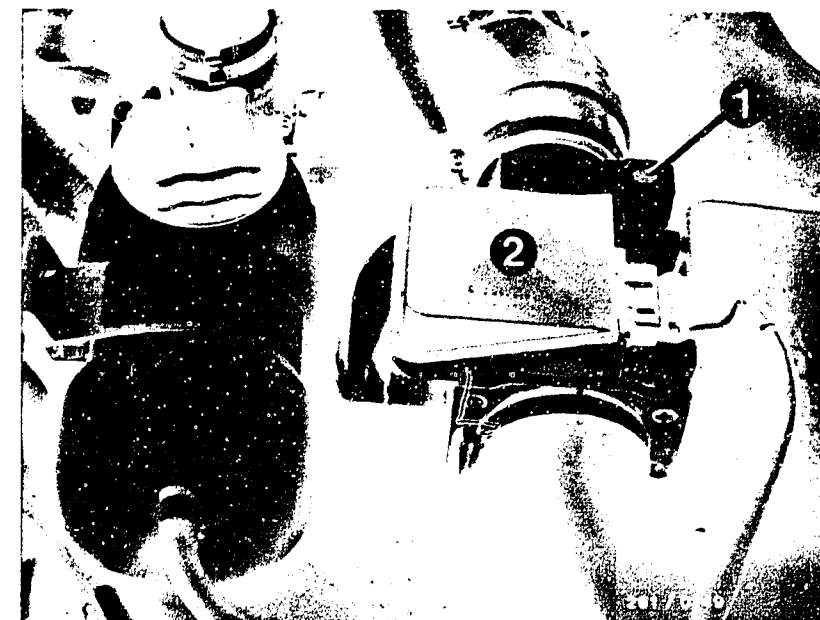
Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

yes

Continued on H19/H20



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Arrow = Idle actuator



**H17**

Uneven engine idle  
Volvo 740/760 Turbo



**H18**

Uneven engine idle  
Volvo 740/760 Turbo



# Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Thermo-time switch O.K.?

Yes

Start valve O.K.?  
(Leak test)

Yes

Continued on H21/H22

No

## Electrical test

Test thermo-time switch 35°/7,5 sec. as follows:  
Remove plug and make direct resistance measurement  
at thermo-time switch using ohmmeter.

	Between term. "G" + ground	Between term. "W" + ground	Between term. "G" + "W"
Ambient temperature (below 30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at normal operating temperature (above 40°C)	50...80 Ω	100...160 Ω	50...80 Ω

No

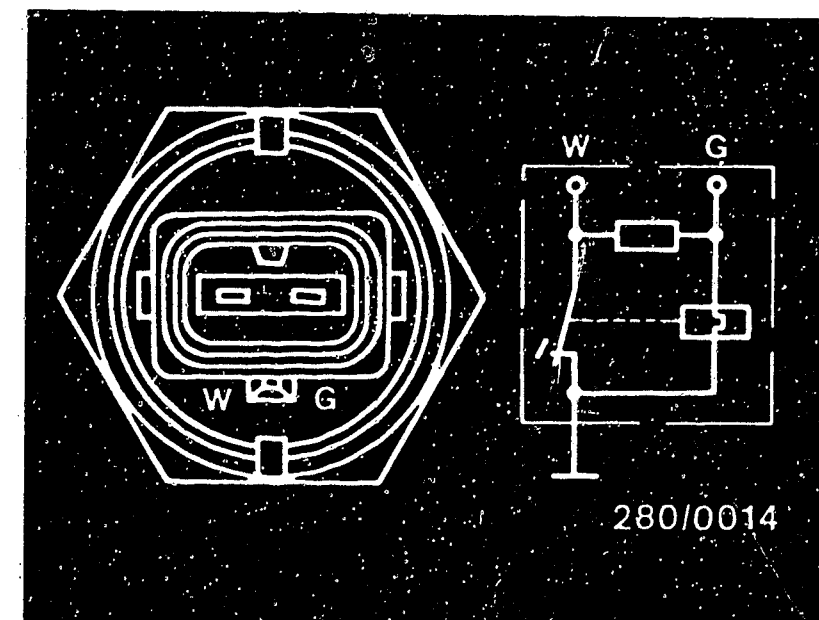
## Checking the start valve for leaks:

### 1. When installed

Pinch off fuel delivery line to start valve. If  
engine then runs smoothly, replace start valve  
(at bottom on intake manifold).

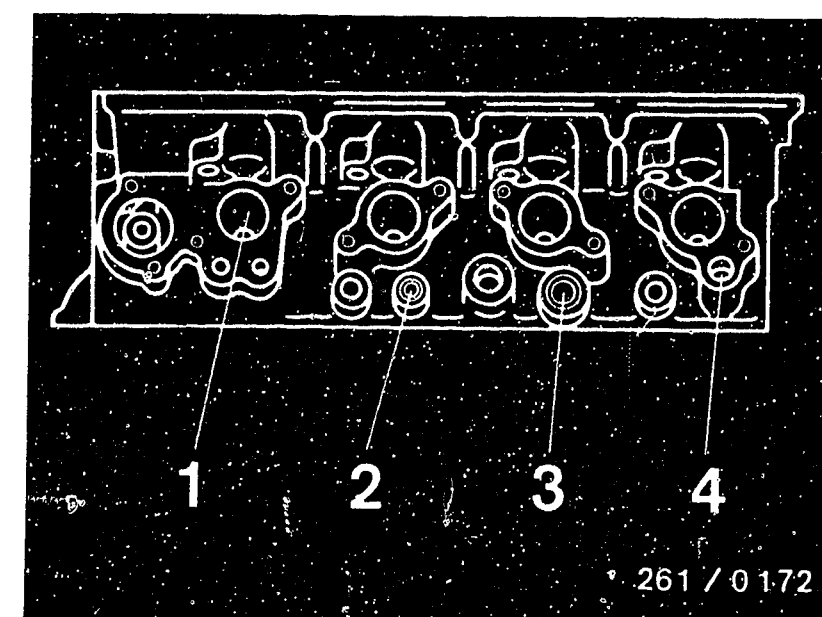
### 2. When removed

Remove start valve (caution - fire hazard!). Fuel  
line and electric lead remain connected (place  
collector vessel under start valve). Build up  
fuel pressure. On universal test adapter, set  
program switch "V" to position 17. Switch on  
ignition and press button T 3.



Thermo-time switch

- 1 = Cylinder 1 (intake manifold removed)
- 2 = Sensor for indication in instrument panel
- 3 = Engine temperature sensor (NTC II)
- 4 = Thermo-time switch



**H19**

Uneven engine idle  
Volvo 740/760 Turbo



**H20**

Uneven engine idle  
Volvo 740/760 Turbo





# Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

yes

Time-delay relay O.K.?  
(Injection valve of cylinder 2  
not clicking)

no

Operation of time-delay relay:  
If the overdrive is operated in 4th gear  
under load, the time-delay relay pulls in for  
approx. 0.3 seconds.  
The injection valve of cylinder 2 is then  
switched off for this period via the  
injection output stage in order to reduce the  
engine torque and to permit smooth, gentle  
shifting into overdrive.  
Testing: Disconnect time-delay relay. If  
injection valve of cylinder 2 now operates,  
replace time-delay relay and check the  
associated components and leads according to  
circuit diagram.

yes

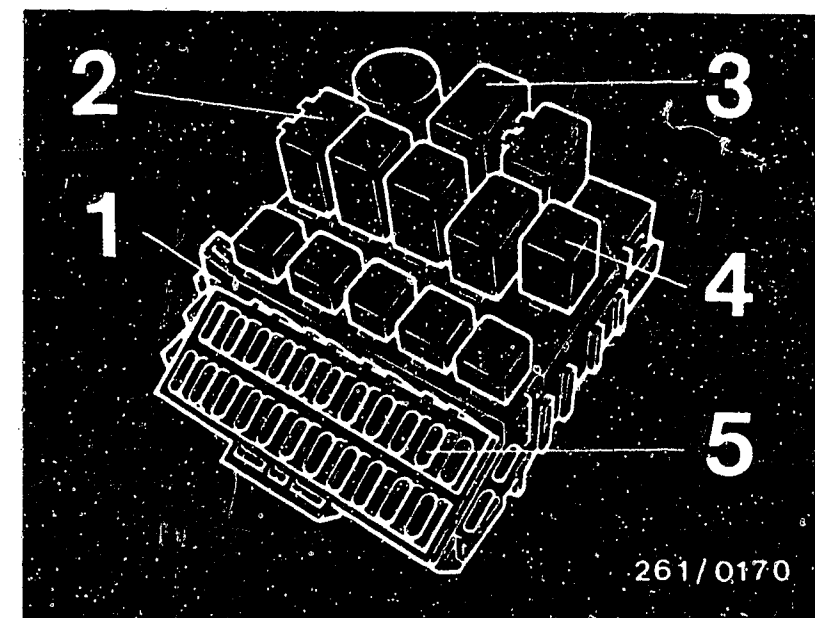
Injection output stage  
functioning?

no

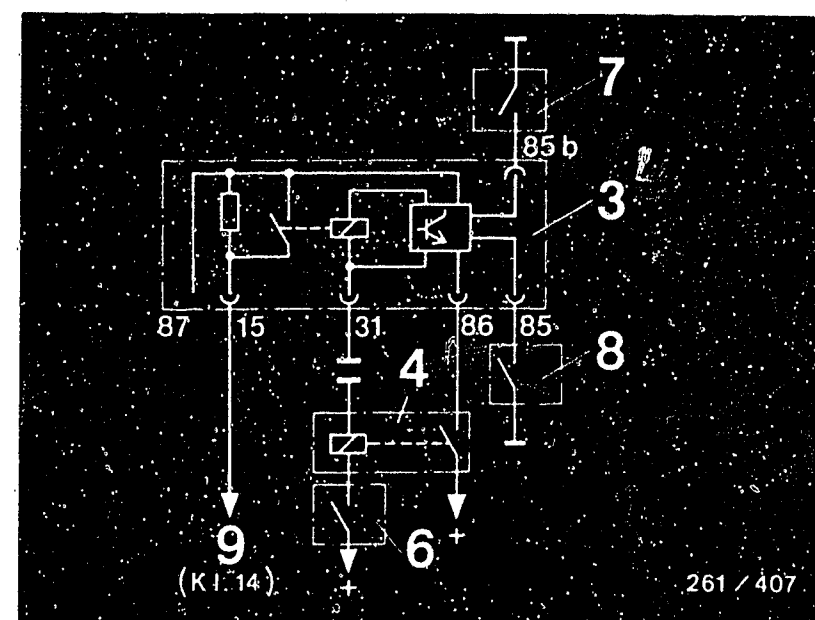
- Start engine and check injection pulses at  
solenoid-operated injection valves with  
oscilloscope (special input). (Use test  
lead 1 684 463 093)
- With ignition off, disconnect 25-pin plug  
to output stage and check the power supply  
(ignition on: 10...15V at term. 1/term. 8).
- Check lead from 25-pin plug (term. 16) to  
Motronic multiple plug (term. 14) as well  
as leads to solenoid-operated injection  
valves (approx. 0  $\Omega$ ).
- Switch off ignition. Disconnect the ETC  
control unit and check injection pulses  
again with oscilloscope. If injection  
output stage functions only with ETC  
control unit disconnected, this points to  
a fault in the ETC system; otherwise  
replace output stage.

yes

Continued on H23/H24



- 1 = Central-electrics box
- 2 = Relay set
- 3 = Time-delay relay
- 4 = Switching relay for overdrive (OD)
- 5 = Fuses
- 6 = Actuating switch for OD
- 7 = Charge-air pressure switch
- 8 = Hydraulic pressure switch on transmission
- 9 = To injection output stage (term. 14)



H21

Uneven engine idle  
Volvo 740/760 Turbo

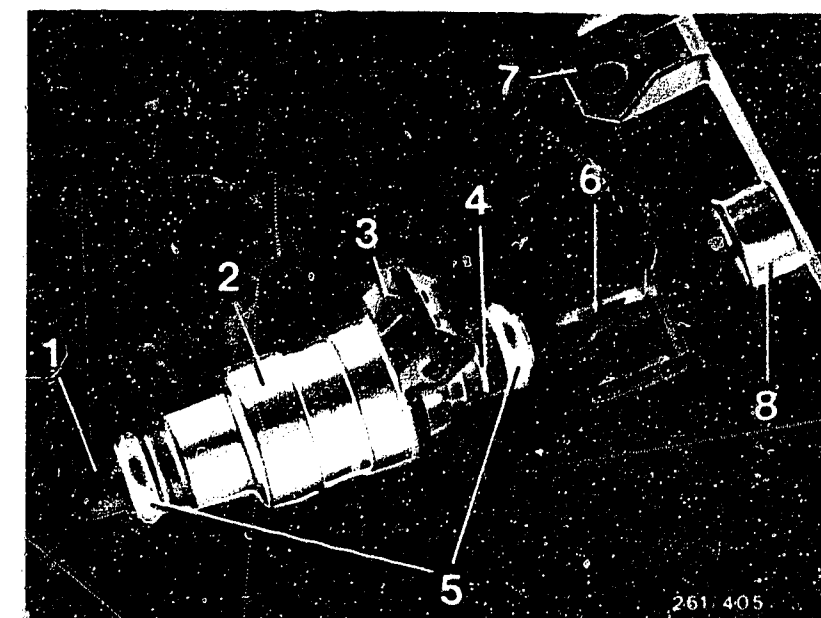
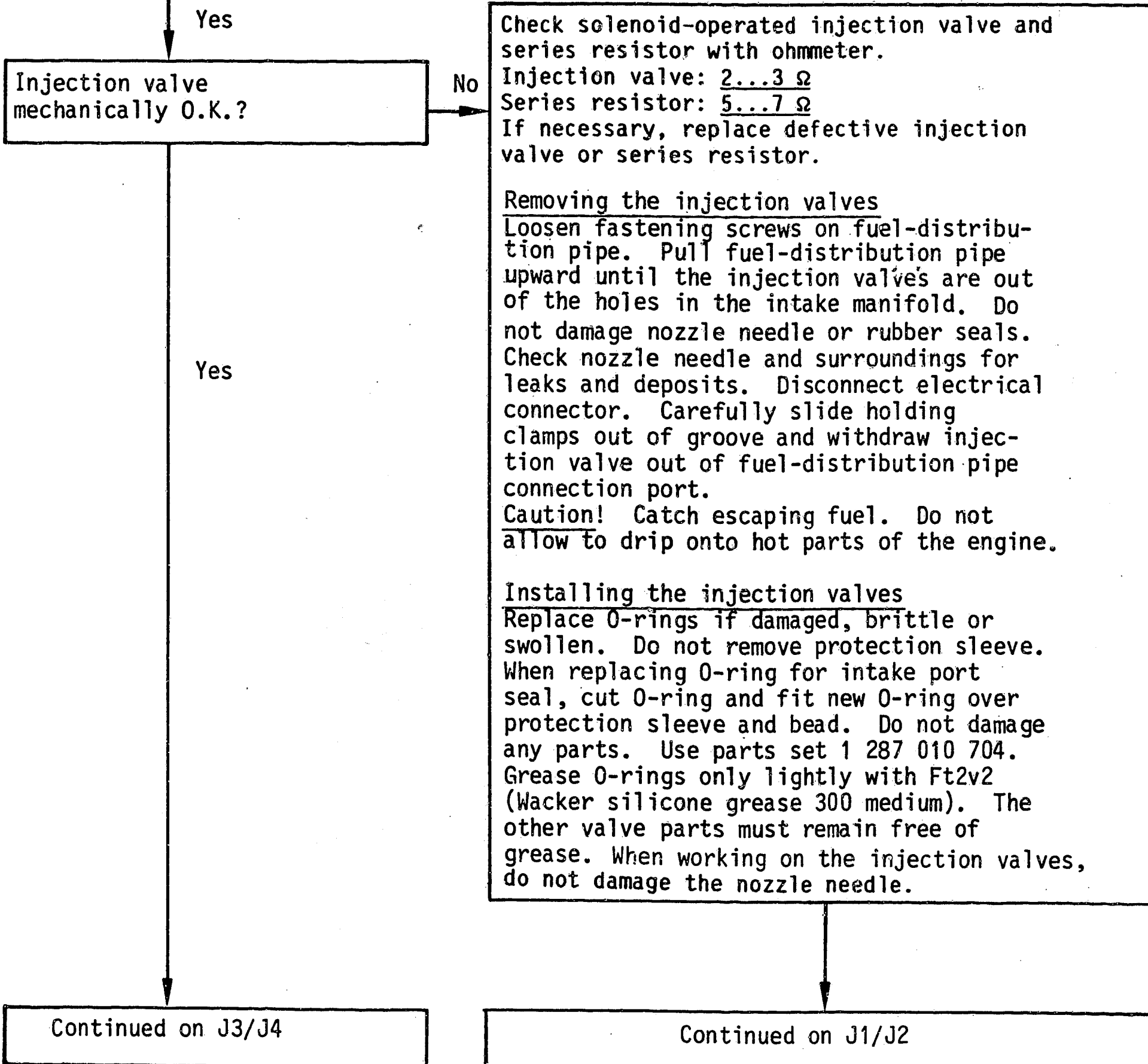


H22

Uneven engine idle  
Volvo 740/760 Turbo



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment  
(continued)



- 1 = Protective sleeve
- 2 = Injection valve
- 3 = Electrical connection
- 4 = Groove
- 5 = Rubber seals (O-ring)
- 6 = Holding clamp
- 7 = Mounting bracket
- 8 = Fuel-distribution pipe connection

H23

Uneven engine idle  
Volvo 740/760 Turbo



H24

Uneven engine idle  
Volvo 740/760 Turbo

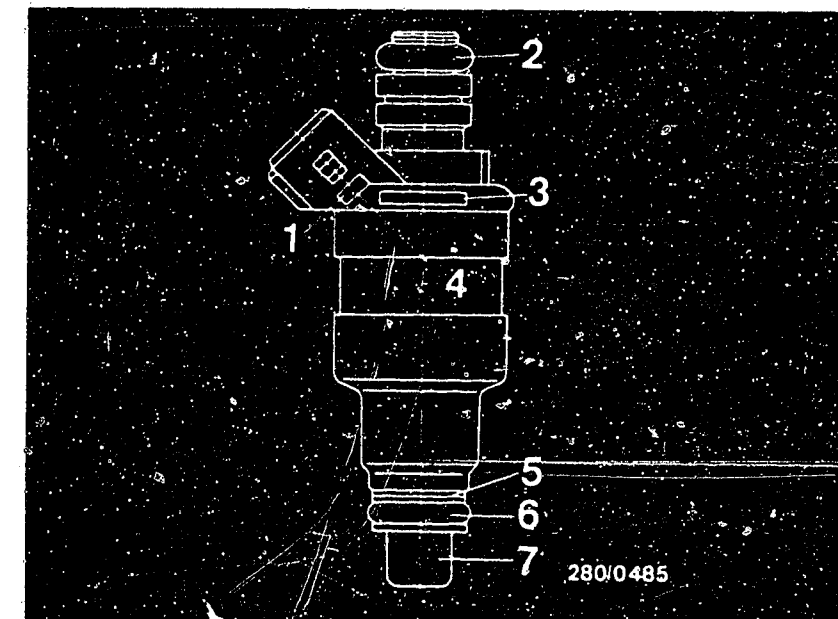


Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment  
(continued)

When working on the injection valves, do not damage the nozzle needle.

Check both rubber seals for correct seating before installing. Press all 4 injection valves uniformly into their seats with the fuel-distribution pipe. Screw down fuel-distribution pipe. Check all air and fuel hoses for correct seating. Make electrical connections.

Start engine and check whether any unmetered air is being drawn in.



- 1 = FD mark
- 2 = Upper O-ring
- 3 = Part number
- 4 = Injection valve
- 5 = Supporting plate
- 6 = Lower O-ring
- 7 = Protection sleeve

Yes

Continued on J3/J4

Uneven engine idle, speed adjustment (idle) and exhaust-gas test (continued)

yes

Idle-speed control O.K.?

no

- Push back protective rubber cap on plug to idle actuator and, using test prods with plug connected, check the voltage at term. 3 and 5 to term. 4 with oscilloscope (bottom diagram). If no pulses, check leads to idle controller (terminals 3, 4, 5).  
Record on/off ratio at idle actuator at 900 min<sup>-1</sup> with dwell-angle tester, term. 3/4: 67...77%, term. 5/4: 23...33% (engine at operating temperature, switch off electrical devices).
- Measure winding resistance of actuator (at +15°C ...+30°C); term. 3/4: 19...25 Ω; term. 5/4: 17...22.5 Ω (to do this, disconnect plug).
- Further trouble-shooting: actuator mechanically defective, e.g. slide stiff.

Idle controller O.K.?

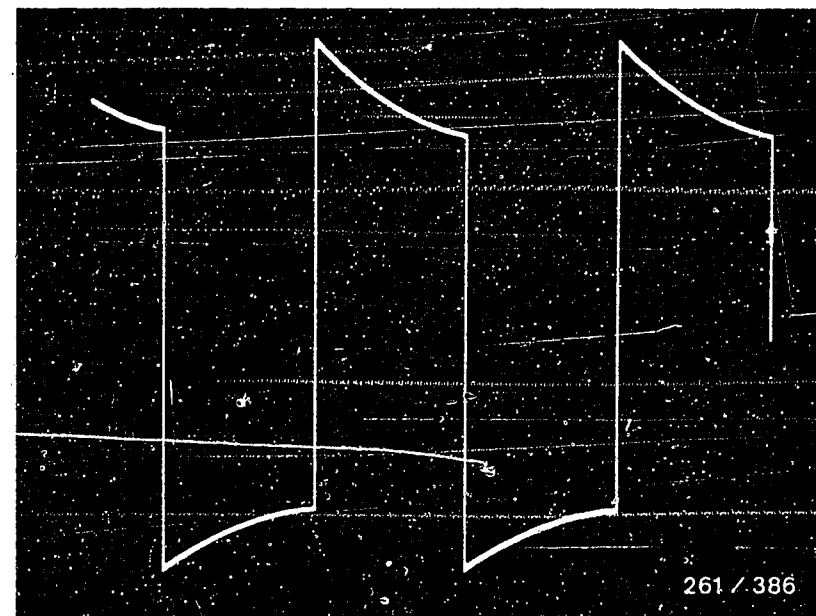
- Dwell-period signal present at term. 12 of controller?  
Measurement with controller connected, directly at rear on plug (engine idling).
- Power supply (10...15 V) at term. 1/2.  
Switch on ignition.
- Idle contact closing with throttle valve closed?  
- Approx. 0 V then at term. 8?
- Check double temperature sensor (NTC II).  
Switch off ignition and disconnect plug to controller.  
Measure resistance between term. 9 in plug and vehicle ground.  
At +15°C...+30°C: 1.45...3.3 kΩ  
+80°C: 280...360 Ω
- With air conditioner off, there must be no battery voltage at term. 7.

yes

Continued on J5/J6



Arrow = Idle actuator



**J3**

Uneven engine idle  
Volvo 740/760 Turbo



**J4**

Uneven engine idle  
Volvo 740/760 Turbo



# Uneven engine idle, speed adjustment (idle) and exhaust-gas test (continued)

Yes

Idle speed with engine at operating temperature:  
900 min<sup>-1</sup>

CO concentration with engine at operating temperature:  
Checking value:

0.5 ... 2.0 % by vol. CO

Setting value:  
1.0% by vol. CO

No

## Idle-speed adjustment

- Connect test output of idle controller to vehicle ground and switch off all electrical devices.
- Adjust engine speed at idle-adjusting screw to 800 ... 850 min<sup>-1</sup>.
- Checking value for on/off ratio 20...30% (idle actuator: term. 5/4). Then disconnect test output from ground.
- Adjust exhaust with idle-mixture-adjusting screw in air-flow sensor. To do this, remove plug (turning to the right enriches mixture).

## If CO not adjustable:

- CO concentration too low: repeat leak test on intake system.
  - CO concentration too high: check air-flow sensor; Repeat measurement with crankcase ventilation hose disconnected (gasoline in oil?).
- Note: After CO adjustment, insert new plug (red) in air-flow sensor.

Yes

Testing completed for customer complaint

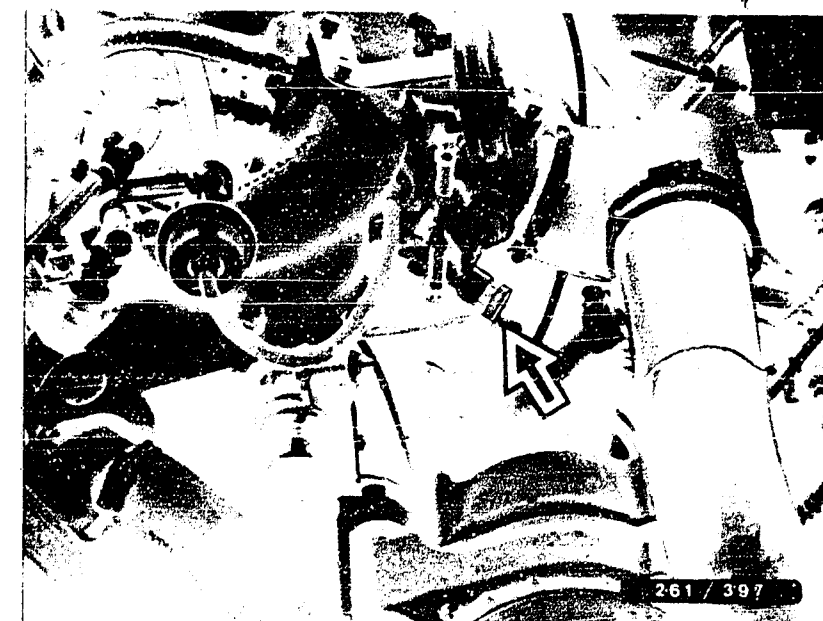
"Uneven engine idle"

Customer complaint remedied?

No

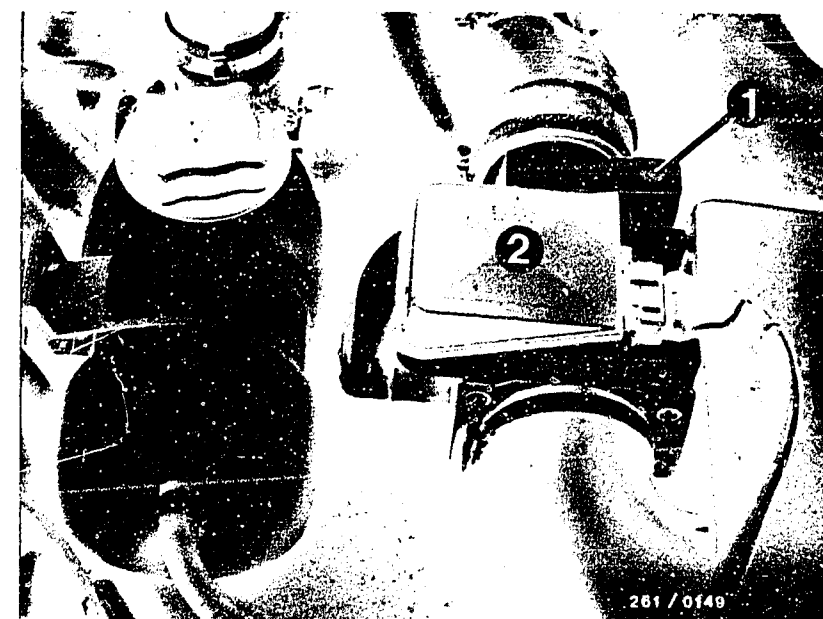
## Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble shooting" (Coordinates C3/C4).
- Engine not mechanically O.K. (compression, valve setting, valve timing, worn camshaft).



Arrow = Idle-speed adjusting screw

1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I



J5

Uneven engine idle  
Volvo 740/760 Turbo



J6

Uneven engine idle  
Volvo 740/760 Turbo



## POOR THROTTLE TAKE-UP

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

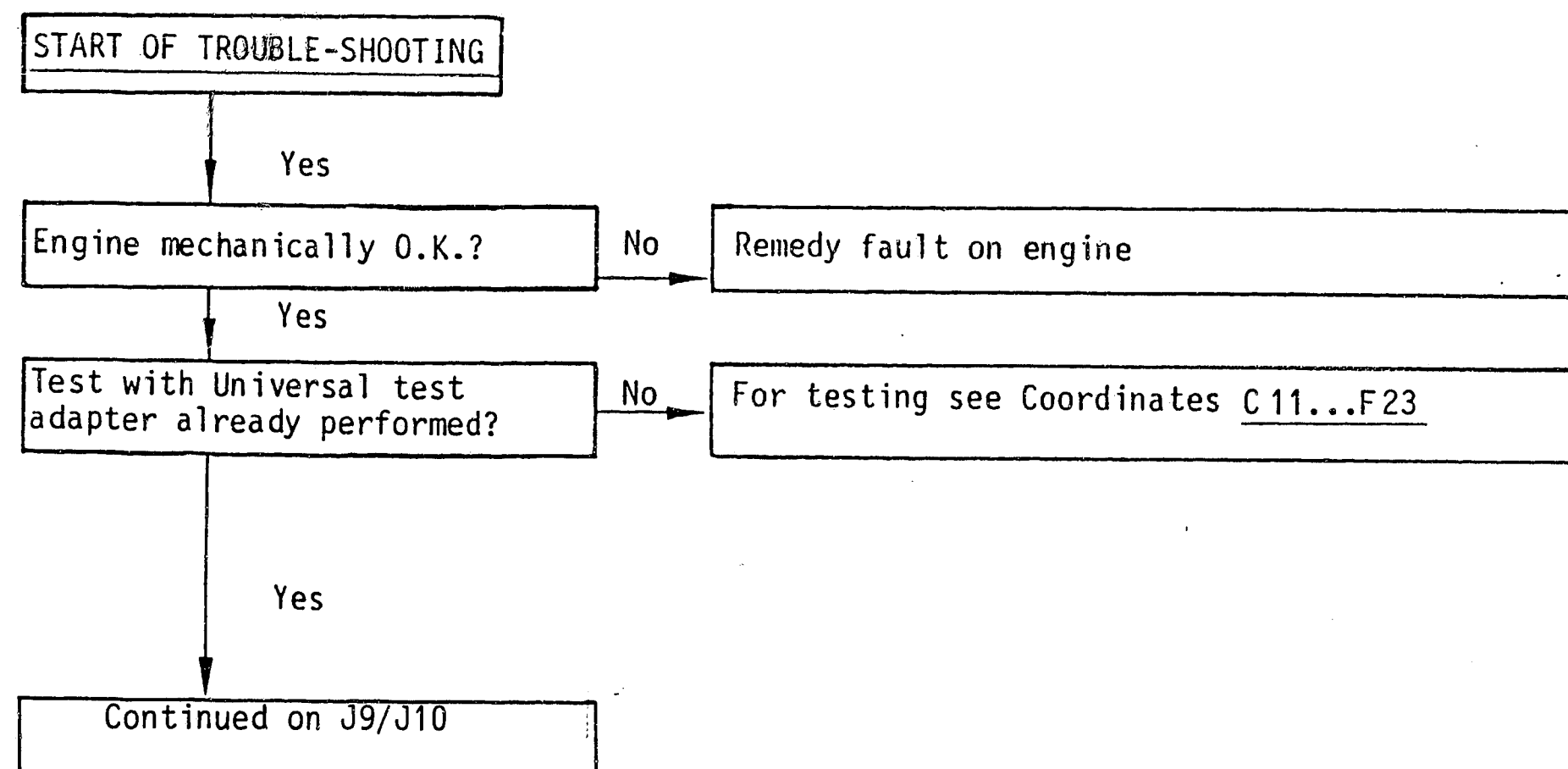
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**J7**

Poor throttle take-up  
Volvo 740/760 Turbo



**J8**

Poor throttle take-up  
Volvo 740/760 Turbo



Poor throttle take-up (continued)

Yes

Check secondary pattern of all cylinders at cranking speed. Secondary pattern O.K.?

No

Check ignition coil and high-voltage distributor. Check distributor cap for dirt and arcing damage. Make sure that the plastic part is installed in the mounting slot of the high-voltage distributor. With this plastic part the high-voltage distributor is correctly adjusted. Note the cylinder numbers when connecting the H.T. cables. Do not forget screening cover. Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5 to 7.2 k  $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor: 1 k $\Omega$

Distributor outer dome: 1 k $\Omega$

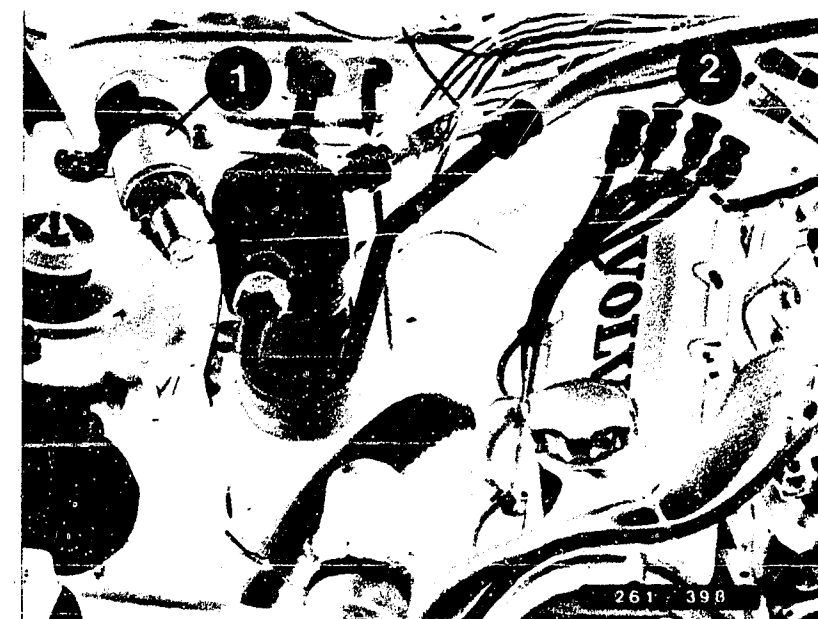
Distributor center dome: 0 k $\Omega$

Spark-plug connector: 5 k $\Omega$

Ignition coil: 0 k $\Omega$

Yes

Continued on J11/J12



1 = Ignition coil

2 = High-voltage distributor

**J9**

Poor throttle take-up  
Volvo 740/760 Turbo



**J10**

Poor throttle take-up  
Volvo 740/760 Turbo



# Poor throttle take-up (continued)

Yes

Air-flow sensor mechanically O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

Are all hose lines and electric leads securely attached? Visual examination. Is the air-intake system leak-tight?

No

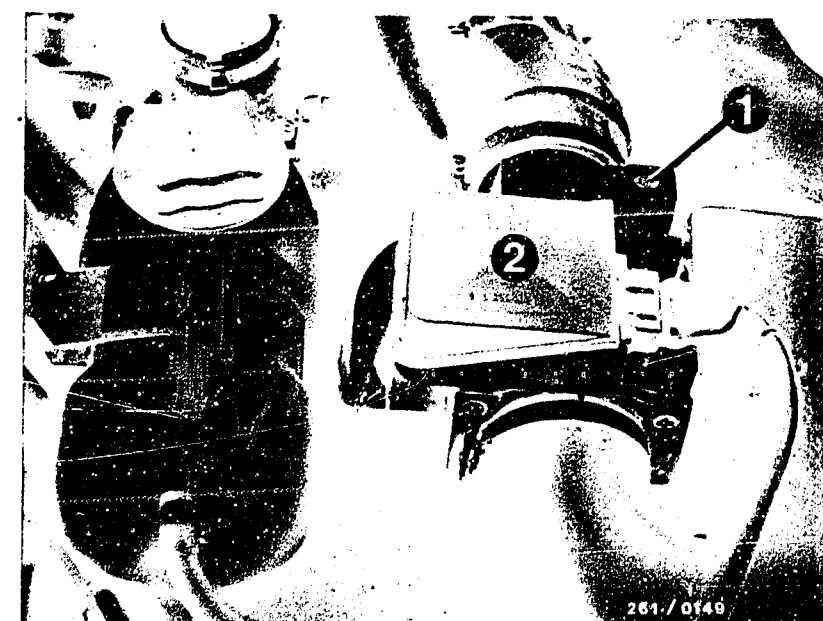
Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

## Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

Yes

Continued on J13/J14



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Arrow = Idle actuator



**J11**

Poor throttle take-up  
Volvo 740/760 Turbo



**J12**

Poor throttle take-up  
Volvo 740/760 Turbo





Poor throttle take-off (continued)

yes

Idle-speed control O.K.?

no

- Push back protective rubber cap on plug to idle actuator and, using test prods with plug connected, check the voltage at term. 3 and 5 to term. 4 with oscilloscope (bottom diagram). If no pulses, check leads to idle controller (terminals 3, 4, 5).  
Record on/off ratio at idle actuator at 900 min<sup>-1</sup> with dwell-angle tester, term. 3/4: 67...77%, term. 5/4: 23...33% (engine at operating temperature, switch off electrical devices).
- Measure winding resistance of actuator (at +15°C ...+30°C); term. 3/4: 19...25 Ω; term. 5/4: 17...22.5 Ω (to do this, disconnect plug).
- Further trouble-shooting: actuator mechanically defective, e.g. slide stiff.

Idle controller O.K.?

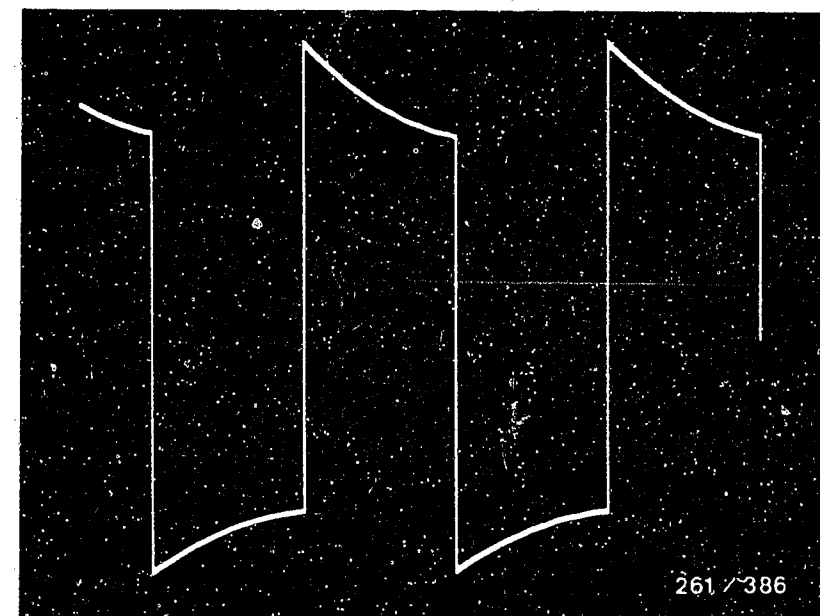
- Dwell-period signal present at term. 12 of controller?  
Measurement with controller connected, directly at rear on plug (engine idling).
- Power supply (10...15 V) at term. 1/2.  
Switch on ignition.
- Idle contact closing with throttle valve closed?  
- Approx. 0 V then at term. 8?
- Check double temperature sensor (NTC II).  
Switch off ignition and disconnect plug to controller.  
Measure resistance between term. 9 in plug and vehicle ground.  
At +15°C...+30°C: 1.45...3.3 kΩ  
+80°C: 280...360 Ω
- With air conditioner off, there must be no battery voltage at term. 7.

yes

Continued on J15/J16



Arrow = Idle actuator



**J13**

Poor throttle take-up  
Volvo 740/760 Turbo



**J14**

Poor throttle take-up  
Volvo 740/760 Turbo



Poor throttle take-up (continued)

Yes

Testing completed for customer complaint

"Poor throttle take-up"

Customer complaint remedied?

No

Further possibilities:

- Customer complaint incorrectly diagnosed (See Coordinates C3...C10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**J15**

Poor throttle take-up  
Volvo 740/760 Turbo



**J16**

Poor throttle take-up  
Volvo 740/760 Turbo



## ENGINE MISSING UNDER ALL OPERATING CONDITIONS

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

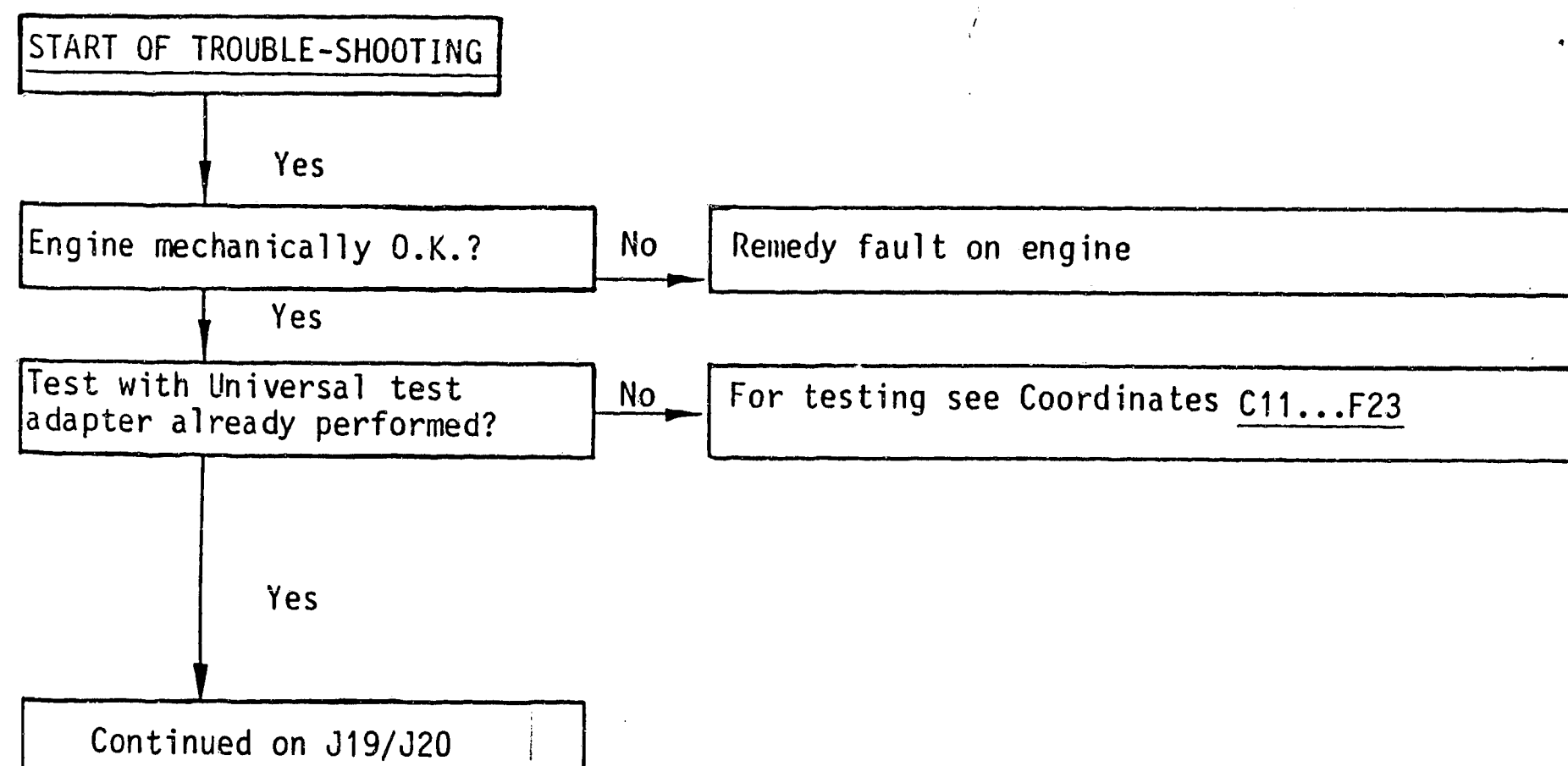
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**J17**

Engine missing  
Volvo 740/760 Turbo

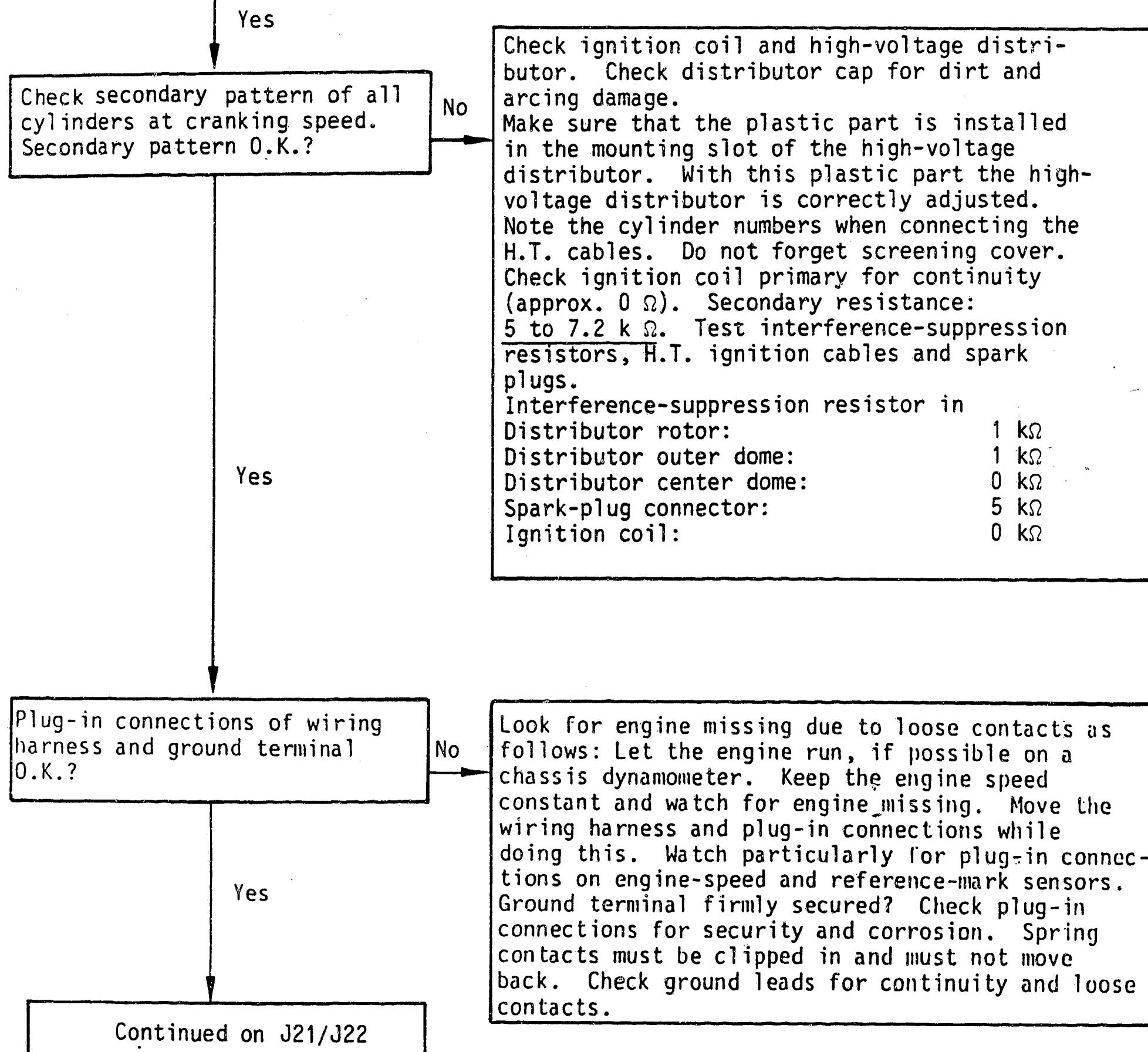


**J18**

Engine missing  
Volvo 740/760 Turbo



Engine missing under all operating conditions (continued)



1 = Ignition coil  
2 = High-voltage distributor



Engine missing under all operating conditions (continued)

Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

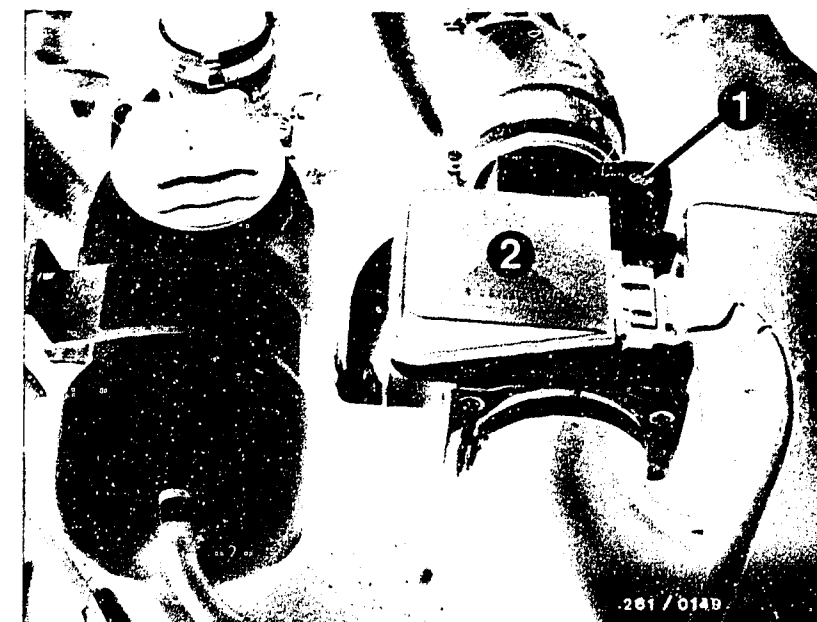
Potentiometer test (noise test)

Remove air-flow sensor. Leave plug on. Set motortester to special input and connect using special cable to air-flow sensor term. 7 (red clip) and term. 6 (black clip). Set control stick for image adjustment on motortester as far as it will go to the left (calibrated setting). Deflect air-flow sensor flap suddenly (several times).

If air-flow sensor O.K., a continuous stroke signal must be visible on the oscilloscope. If air-flow sensor is defective, there is a noise signal similar to that in the diagram opposite. Replace air-flow sensor.

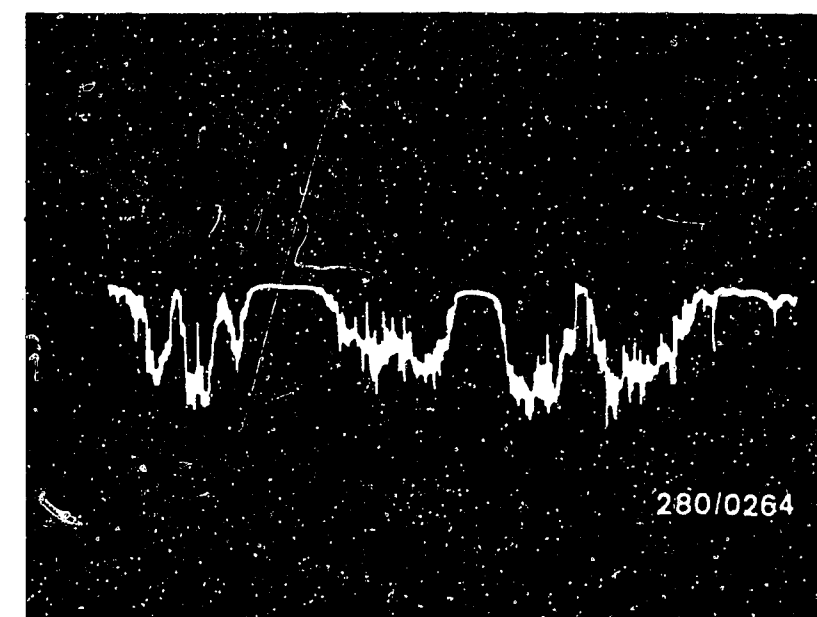
Yes

Continued on J23/J24



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Noise signal if air-flow sensor defective



**J21**

Engine missing  
Volvo 740/760 Turbo



**J22**

Engine missing  
Volvo 740/760 Turbo



# Engine missing under all operating conditions (continued)

Yes

Fuel delivery O.K.?  
Test specification:  
min. 850 cm<sup>3</sup>/30 s

No

## Measuring the fuel delivery:

For testing, loosen fuel return hose from pressure regulator. If necessary, extend hose and lead into a 5 l vessel with graduated scale. Switch on fuel pump with test adapter (program switch "V" at position 17, press button T3).

Test specification: min. 850 cm<sup>3</sup>/30 s

## Remedy if test specification not reached:

- Fuel filter clogged → replace.
- Voltage across fuel pump plugs with engine running min. 12 V → clean contacts, possibly eliminate poor ground connection, replace leads.
- Fuel pressure regulator defective → replace.
- Fuel pump delivery too low → replace fuel pump.

Yes

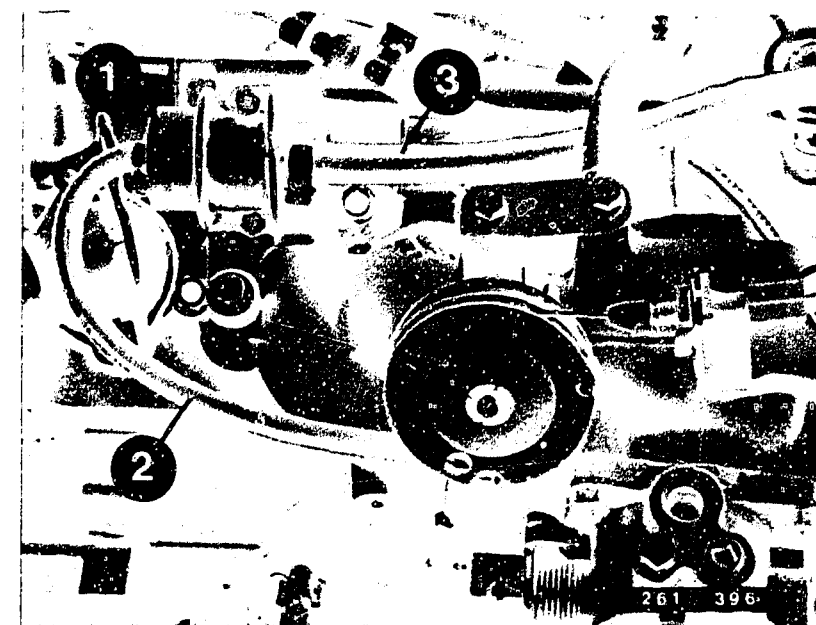
Control unit O.K.?

No

Let engine run. Shake control unit lightly and move multiple plug. Watch for engine missing. Repair plug-in connection on multiple plug or replace defective control unit.

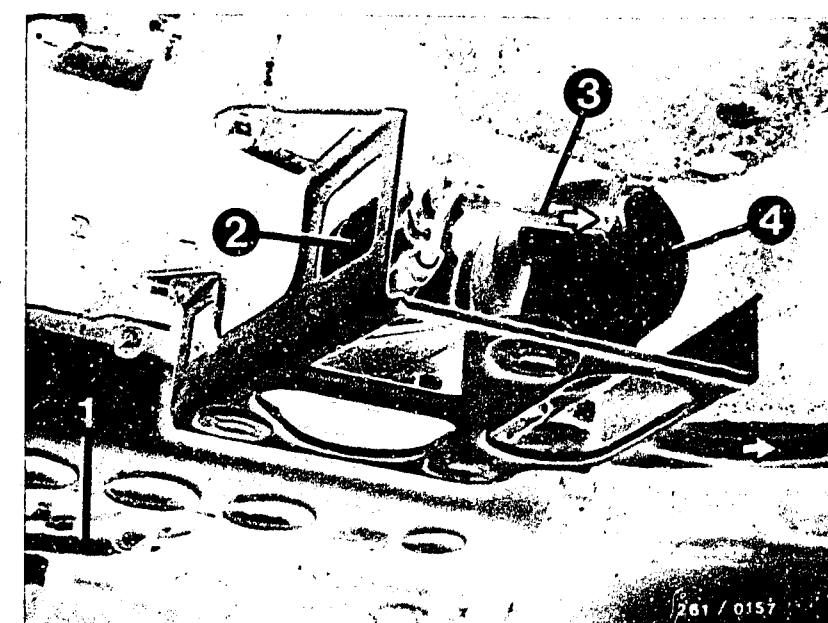
Yes

Continued on K1/K2



- 1 = Pressure regulator
- 2 = Vacuum hose
- 3 = Fuel return line

- 1 = Fuel intake line
  - 2 = Electric fuel pump
  - 3 = Fuel delivery line
  - 4 = Fuel filter
- Arrows = Direction of flow



J23

Engine missing

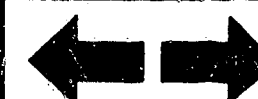
Volvo 740/760 Turbo



J24

Engine missing

Volvo 740/760 Turbo



# Engine missing under off operating conditions (continued)

yes

Time-delay relay O.K.?  
(Injection valve of cylinder 2  
not clicking)

no

Operation of time-delay relay:  
If the overdrive is operated in 4th gear  
under load, the time-delay relay pulls in for  
approx. 0.3 seconds.  
The injection valve of cylinder 2 is then  
switched off for this period via the  
injection output stage in order to reduce the  
engine torque and to permit smooth, gentle  
shifting into overdrive.  
Testing: Disconnect time-delay relay. If  
injection valve of cylinder 2 now operates,  
replace time-delay relay and check the  
associated components and leads according to  
circuit diagram.

yes

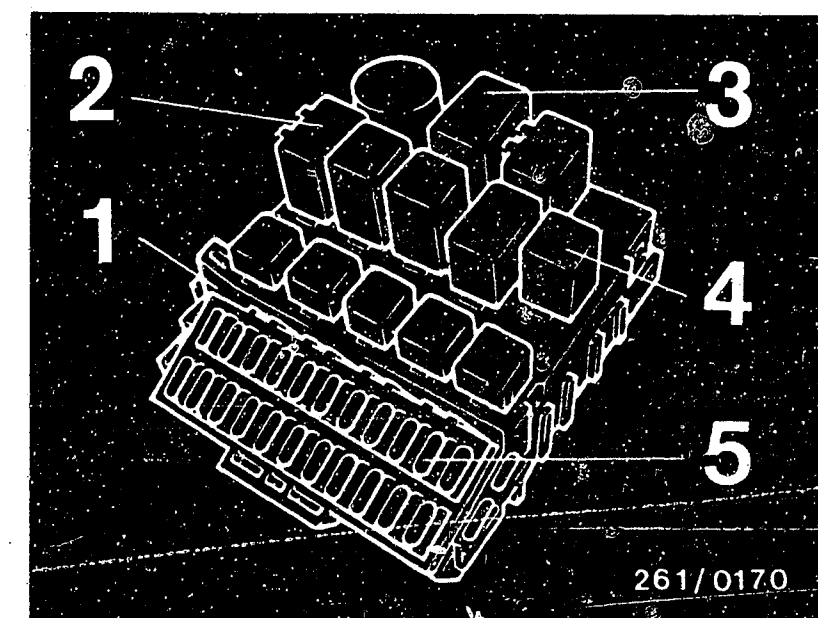
Injection output stage  
functioning?

no

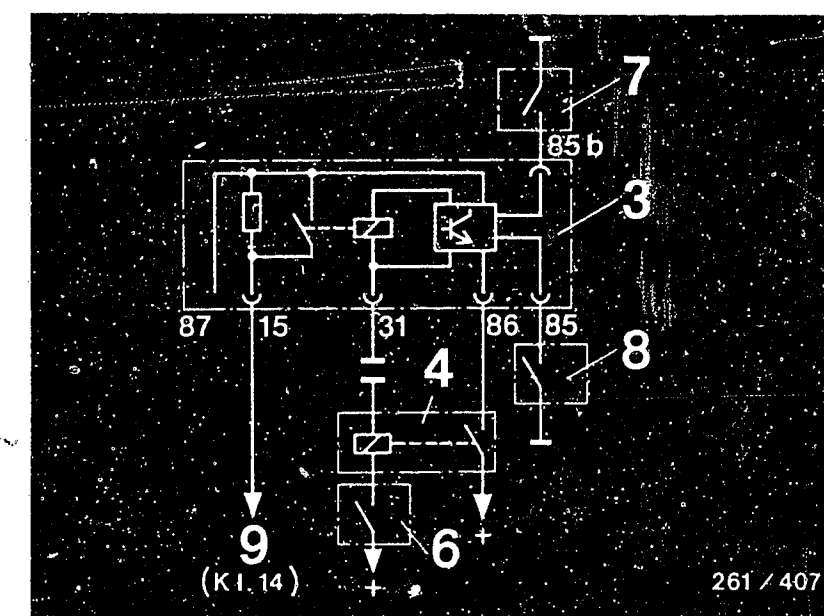
- Start engine and check injection pulses at  
solenoid-operated injection valves with  
oscilloscope (special input). (Use test  
lead 1 684 463 093)
- With ignition off, disconnect 25-pin plug  
to output stage and check the power supply  
(ignition on: 10...15V at term. 1/term. 8).
- Check lead from 25-pin plug (term. 16) to  
Motronic multiple plug (term. 14) as well  
as leads to solenoid-operated injection  
valves (approx. 0  $\Omega$ ).
- Switch off ignition. Disconnect the ETC  
control unit and check injection pulses  
again with oscilloscope. If injection  
output stage functions only with ETC  
control unit disconnected, this points to  
a fault in the ETC system; otherwise  
replace output stage.

yes

Continued on K3/K4



- 1 = Central-electrics box
- 2 = Relay set
- 3 = Time-delay relay
- 4 = Switching relay for overdrive  
(OD)
- 5 = Fuses
- 6 = Actuating switch for OD
- 7 = Charge-air pressure switch
- 8 = Hydraulic pressure switch on  
transmission
- 9 = To injection output stage (term.  
14)



K1

Engine missing

Volvo 740/760 Turbo



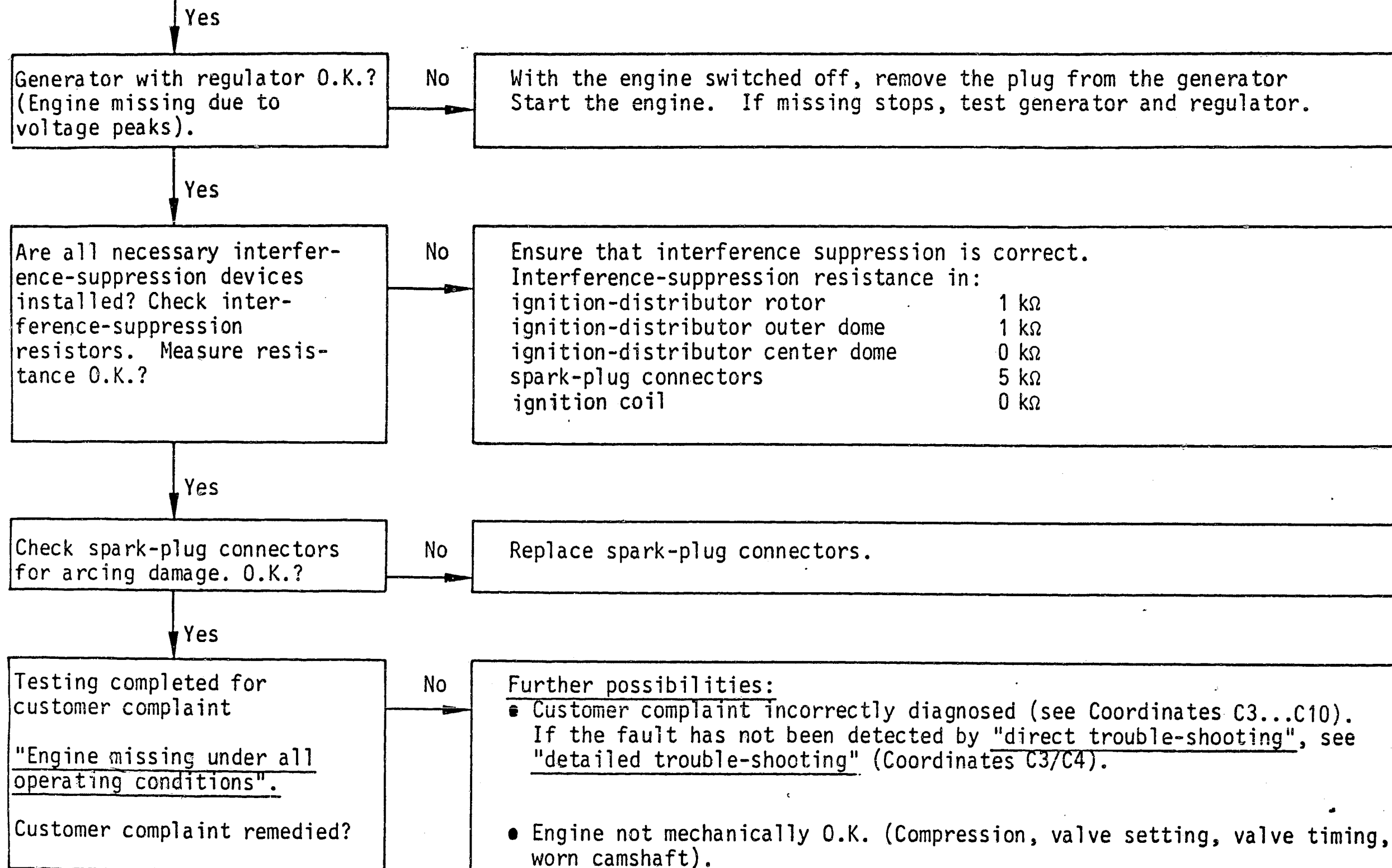
K2

Engine missing

Volvo 740/760 Turbo



Engine missing under all operating conditions (continued)



K3

Engine missing  
Volvo 740/760 Turbo



K4

Engine missing  
Volvo 740/760 Turbo





## FUEL CONSUMPTION TOO HIGH

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

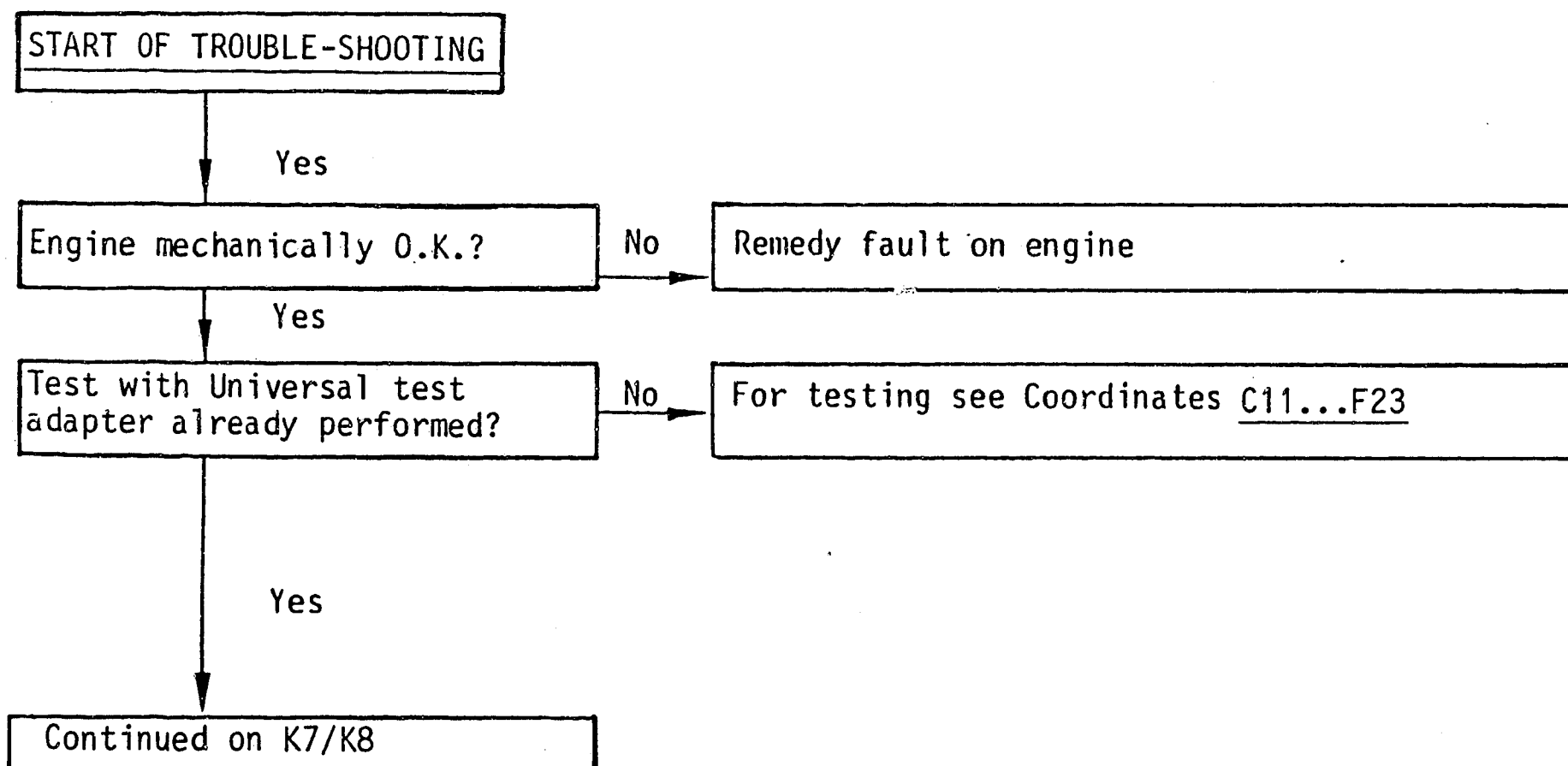
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3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**K5**

Fuel consumption too high  
Volvo 740/760 Turbo



**K6**

Fuel consumption too high  
Volvo 740/760 Turbo



Fuel consumption too high (continued)

Yes

Check secondary pattern of all cylinders at cranking speed. Secondary pattern O.K.?

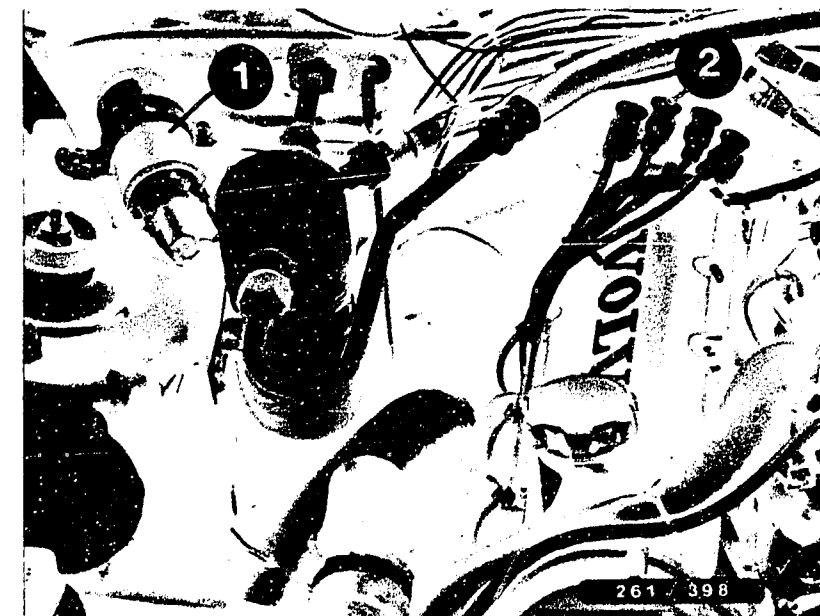
No

Check ignition coil and high-voltage distributor. Check distributor cap for dirt and arcing damage. Make sure that the plastic part is installed in the mounting slot of the high-voltage distributor. With this plastic part the high-voltage distributor is correctly adjusted. Note the cylinder numbers when connecting the H.T. cables. Do not forget screening cover. Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5 to 7.2 k  $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in	
Distributor rotor:	1 k $\Omega$
Distributor outer dome:	1 k $\Omega$
Distributor center dome:	0 k $\Omega$
Spark-plug connector:	5 k $\Omega$
Ignition coil:	0 k $\Omega$

Yes

Continued on K9/K10



1 = Ignition coil  
2 = High-voltage distributor

**K7**

Fuel consumption too high  
Volvo 740/760 Turbo



**K8**

Fuel consumption too high  
Volvo 740/760 Turbo



Fuel consumption too high (continued)

Yes

Have all brakes released fully?

Yes

Start valve O.K.?

no

Testing the start valve for leaks:

1. When installed

Switch over directional-control valve of pressure tester so that start valve is shut off from fuel-distribution pipe. If engine now starts, replace start valve.

2. When removed

Remove start valve (Caution! Fire hazard!)

Fuel line and electric lead remain connected (place collector vessel under the start valve).

Build up fuel pressure:

On the universal test adapter set the program switch "V" to position 17. Switch on the ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on K11/K12



Arrow = Start valve  
(at bottom on intake manifold)

**K9**

Fuel consumption too high  
Volvo 740/760 Turbo

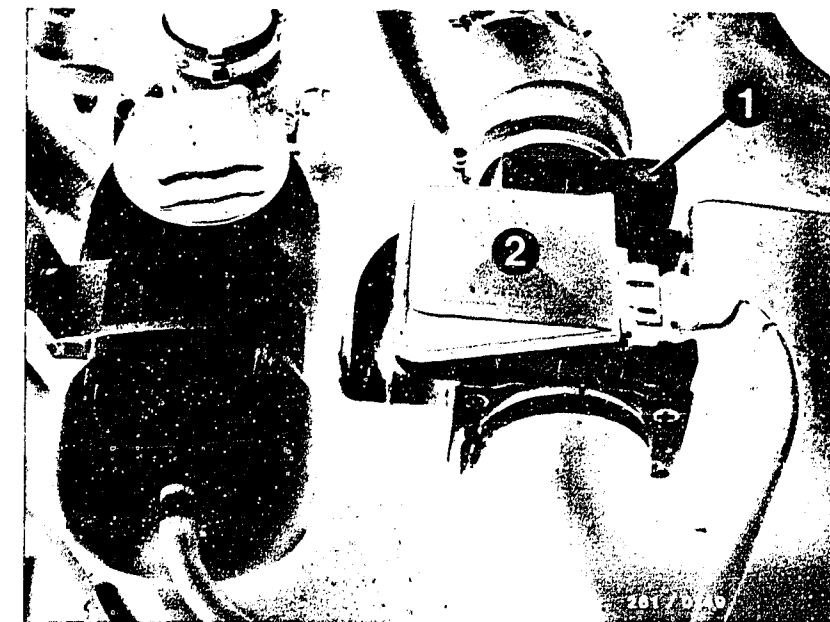
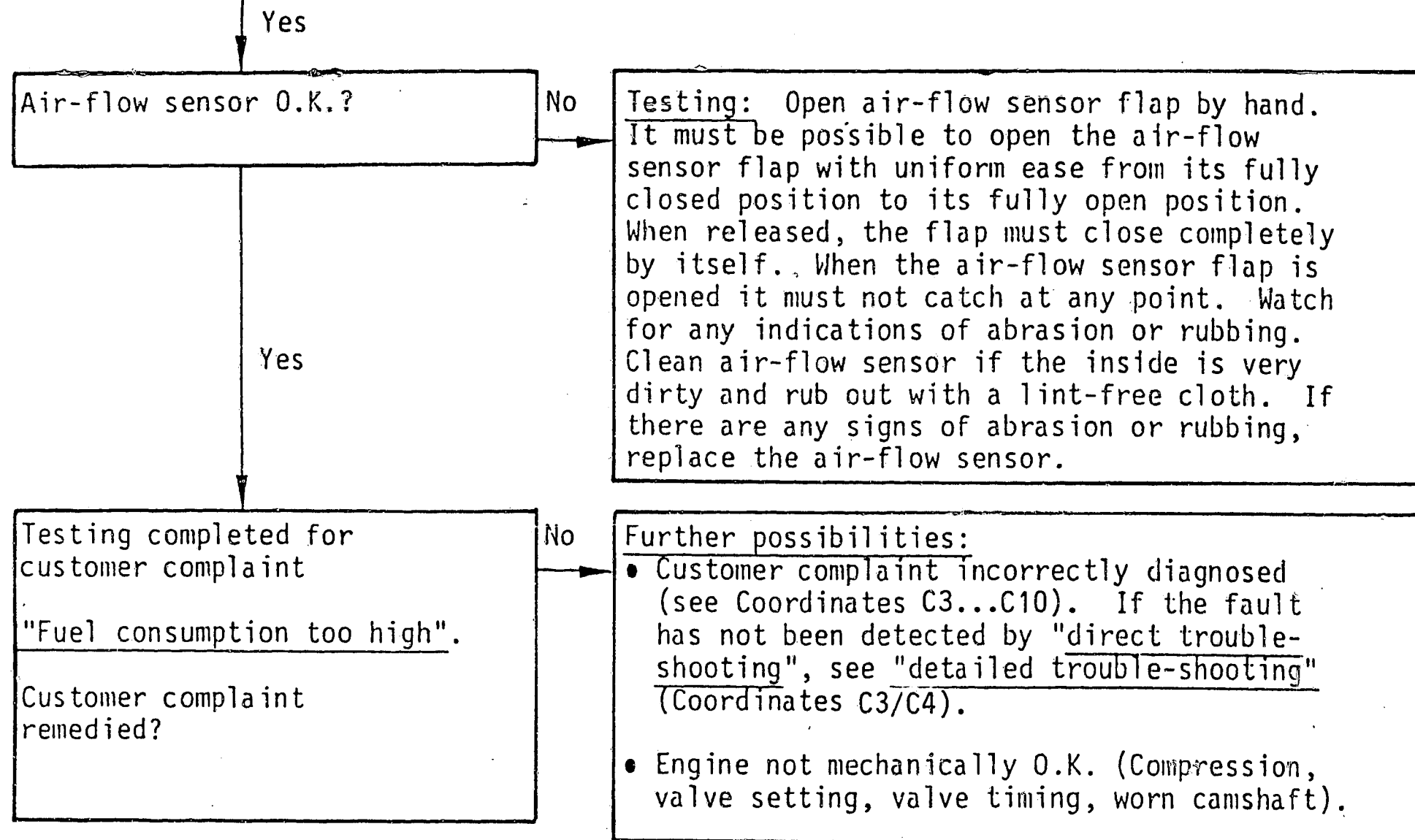


**K10**

Fuel consumption too high  
Volvo 740/760 Turbo



Fuel consumption too high (continued)



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

K11

Fuel consumption too high  
Volvo 740/760 Turbo



K12

Fuel consumption too high  
Volvo 740/760 Turbo



## NO MAXIMUM ENGINE POWER / TOP SPEED NOT REACHED

Trouble-shooting program according to customer complaints

How to use the following trouble-shooting program

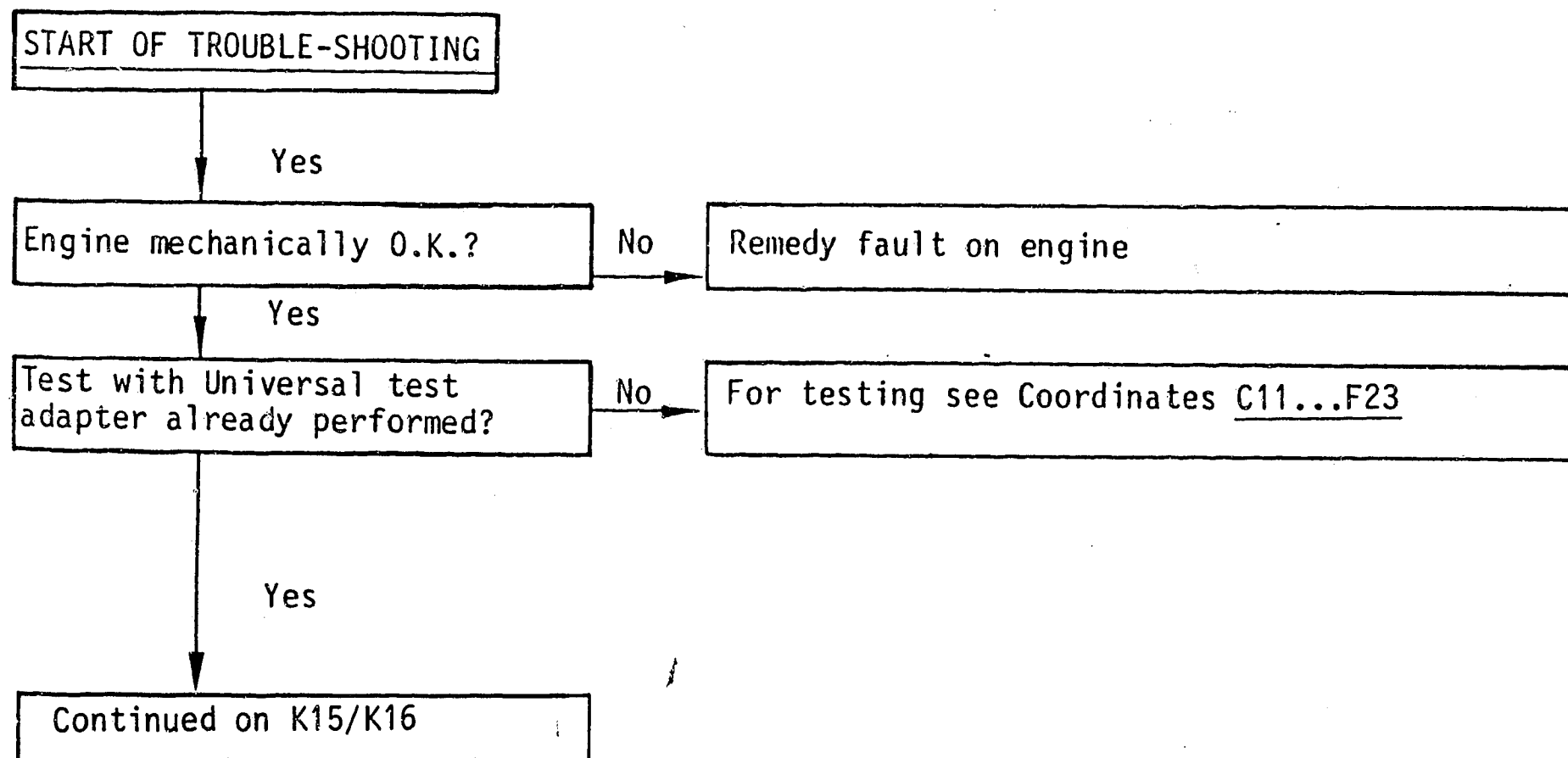
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3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**K13**

No maximum engine power  
Volvo 740/760 Turbo



**K14**

No maximum engine power  
Volvo 740/760 Turbo



No maximum engine power / top speed not reached (continued)

Yes

Check secondary pattern of all cylinders at cranking speed. Secondary pattern O.K.?

no

Check ignition coil and high-voltage distributor. Check distributor cap for dirt and arcing damage. Make sure that the plastic part is installed in the mounting slot of the high-voltage distributor. With this plastic part the high-voltage distributor is correctly adjusted. Note the cylinder numbers when connecting the H.T. cables. Do not forget screening cover. Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5 to 7.2 k  $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in	
Distributor rotor:	1 k $\Omega$
Distributor outer dome:	1 k $\Omega$
Distributor center dome:	0 k $\Omega$
Spark-plug connector:	5 k $\Omega$
Ignition coil:	0 k $\Omega$

Yes

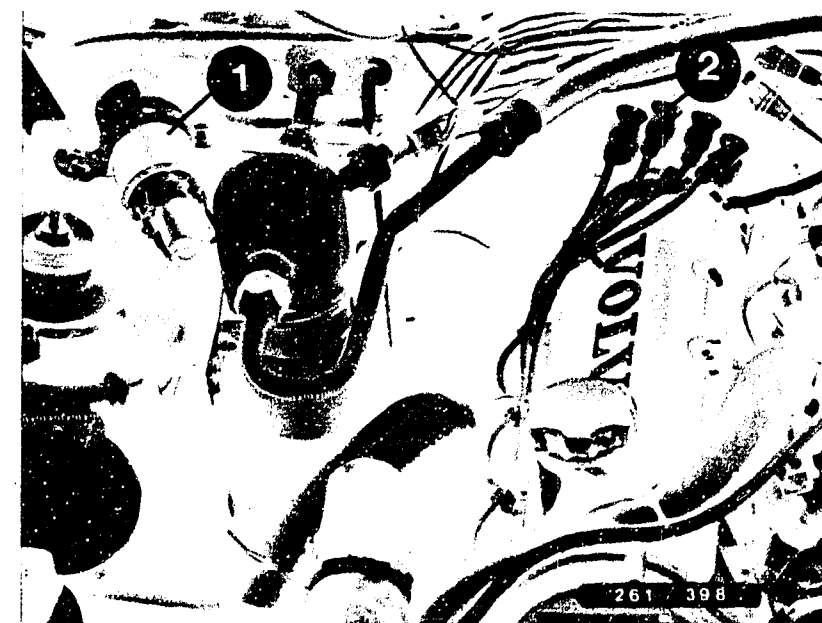
Does throttle valve open fully?

no

Throttle cable, throttle linkage and accelerator O.K.? If necessary, adjust throttle cable and throttle linkage. Accelerator may stick due to floor mat etc.

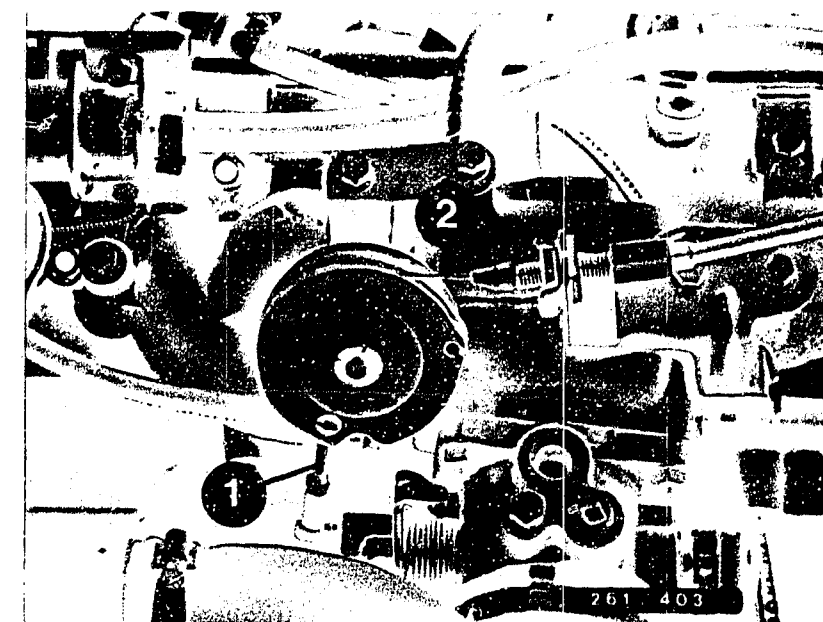
Yes

Continued on K17/K18



1 = Ignition coil  
2 = High-voltage distributor

1 = Throttle linkage  
2 = Throttle cable



**K15**

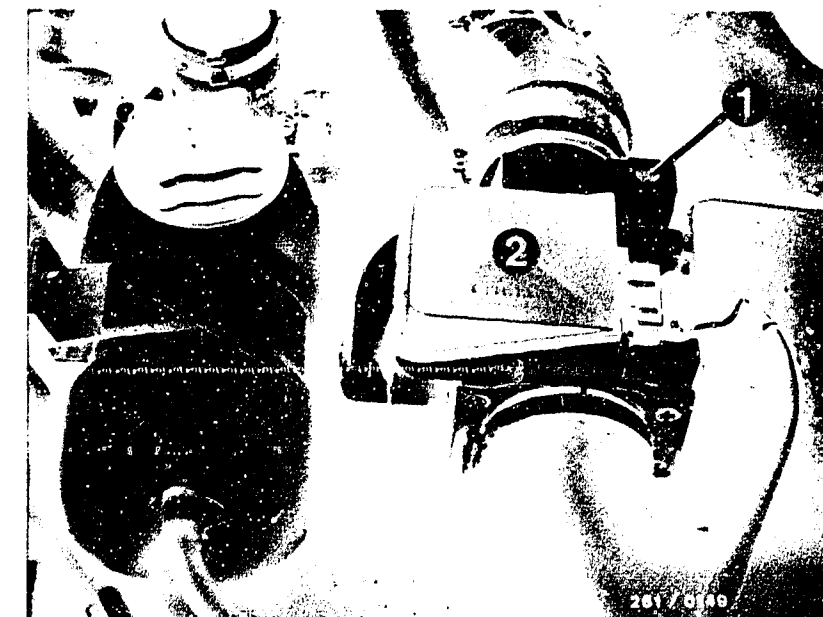
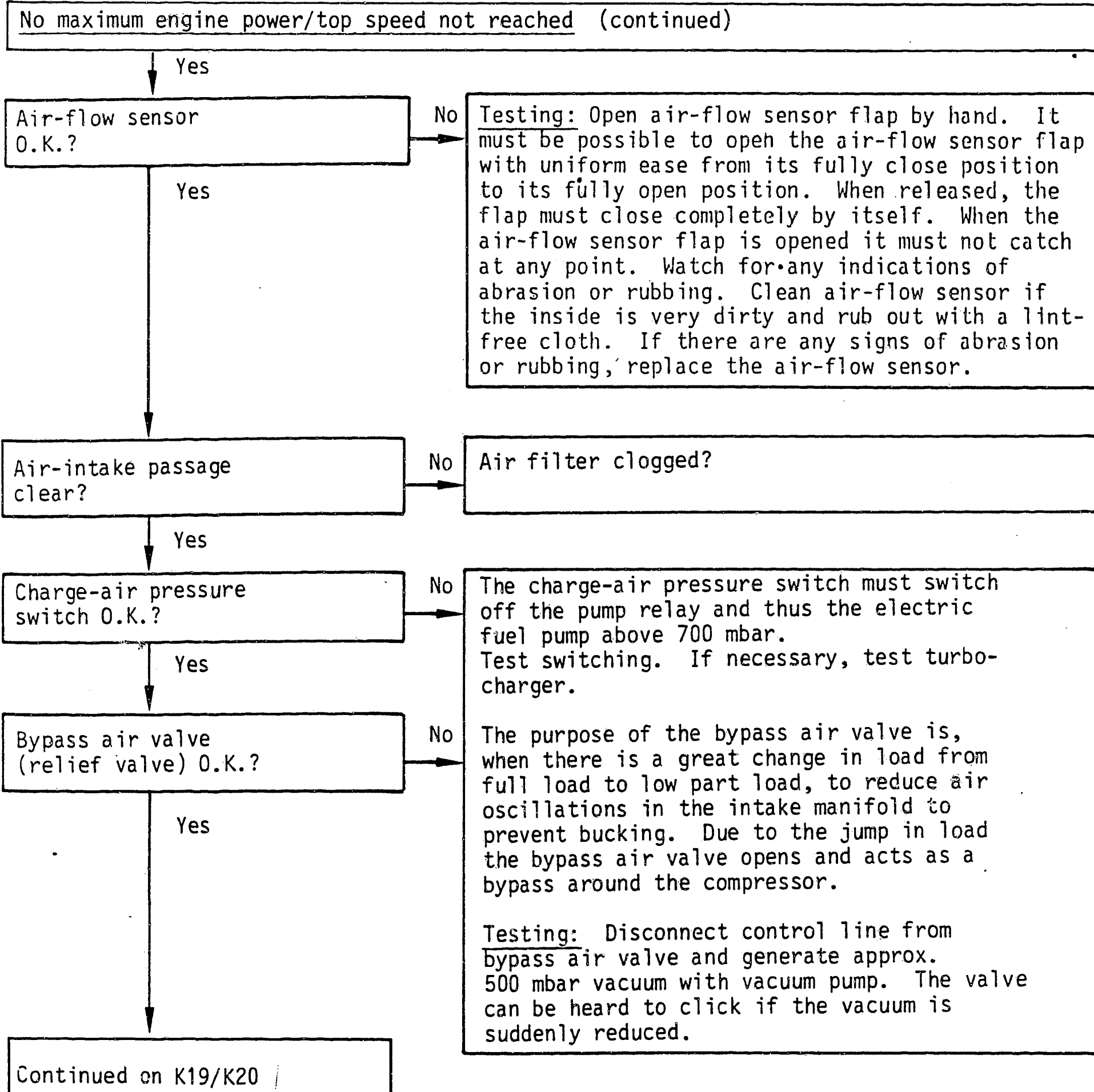
No maximum engine power  
Volvo 740/760 Turbo



**K16**

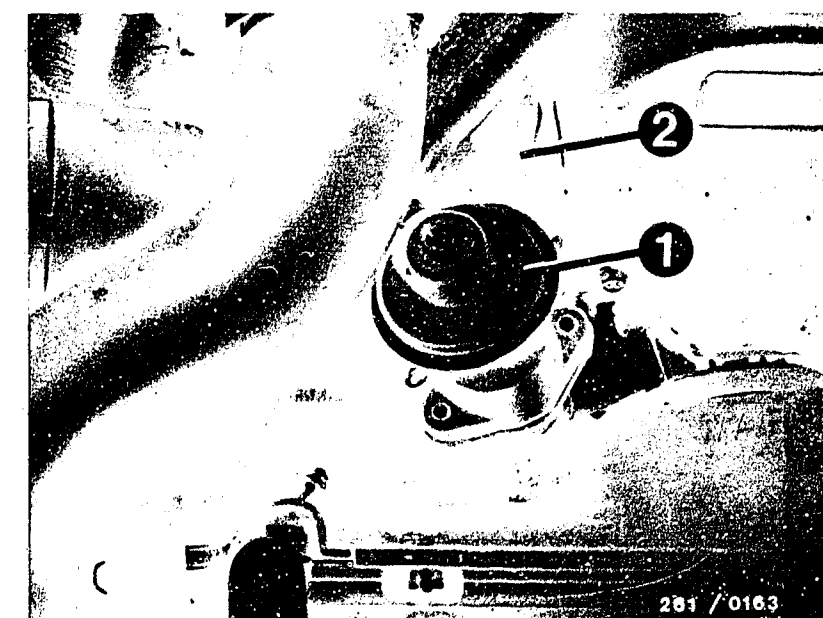
No maximum engine power  
Volvo 740/760 Turbo





1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

1 = Bypass air valve  
2 = Control line



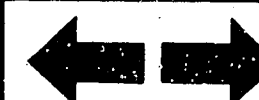
**K17**

No maximum engine power  
Volvo 740/760 Turbo



**K18**

No maximum engine power  
Volvo 740/760 Turbo



No maximum engine power/top speed cannot be reached (continued)

Yes

Fuel delivery O.K.?  
Test specification:  
min. 850 cm<sup>3</sup>/30 s

No

Measuring the fuel delivery:

For testing, loosen fuel return hose from pressure regulator. If necessary, extend hose and lead into a 5 l vessel with graduated scale. Switch on fuel pump with test adapter (program switch "V" at position 17, press button T3).

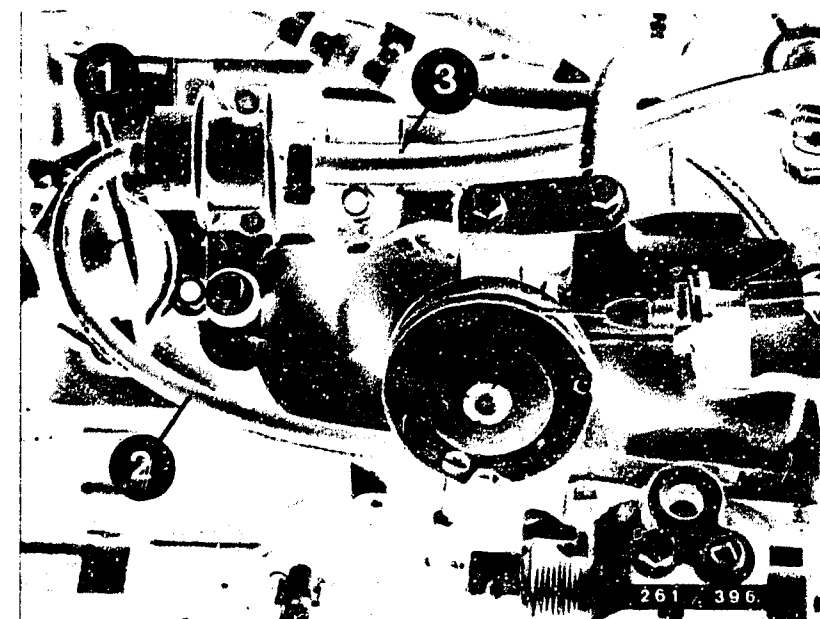
Test specification: min. 850 cm<sup>3</sup>/30 s

Remedy if test specification not reached:

- Fuel filter clogged → replace.
- Voltage across fuel pump plugs with engine running min. 12 V → clean contacts, possibly eliminate poor ground connection, replace leads.
- Check pre-supply pump.  
Listen: Remove connector from electric fuel pump.  
Build up fuel pressure: on universal test adapter, set program switch "V" to position 17. Switch on ignition and press button T 3. Pre-supply pump must operate. If not, check connecting leads and, if necessary, replace pre-supply pump.
- Fuel-pressure regulator defective → replace.
- Fuel pump delivery too low → replace fuel pump.
- Strainer in tank clogged? Corrosion in tank?

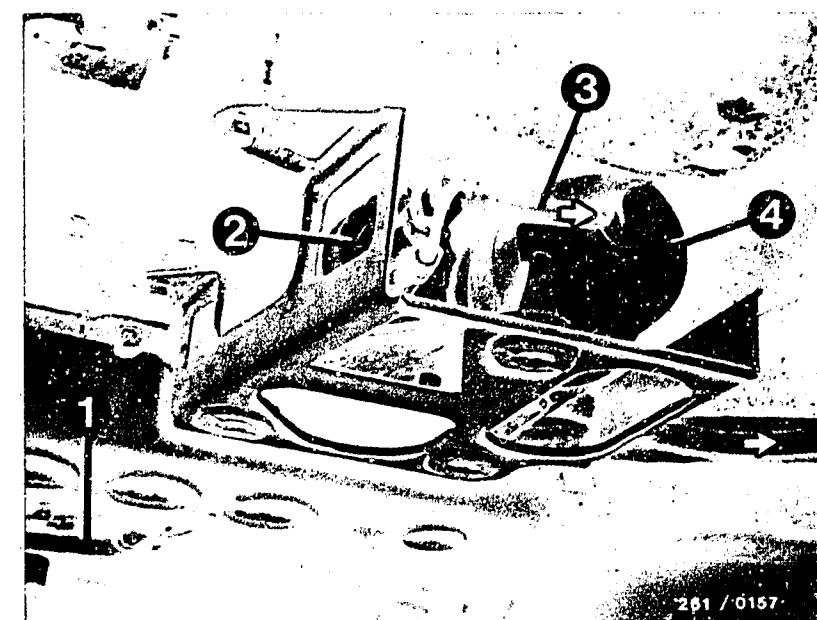
Yes

Continued on K21/K22



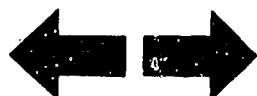
1 = Pressure regulator  
2 = Vacuum hose  
3 = Fuel return line

1 = Fuel intake line  
2 = Electric fuel pump  
3 = Fuel delivery line  
4 = Fuel filter  
Arrows = Direction of flow



**K19**

No maximum engine power  
Volvo 740/760 Turbo



**K20**

No maximum engine power  
Volvo 740/760 Turbo





No maximum engine power/top speed cannot be reached (continued)

Yes

Fuel pressure at full load O.K.?

No

Install pressure tester on start valve.

Caution:

Catch any escaping fuel.

Danger of fire with hot engine and electric sparks

Let engine idle:

Fuel pump pressure approx. 2,5 bar.

Remove air hose to intake manifold on pressure regulator:

Fuel pump pressure: 2,8...3,2 bar (reading may fluctuate slightly). Reconnect air hose.

Test fuel pressure on chassis dynamometer under load (3rd gear, full load braked, approx. 3000 min<sup>-1</sup>):

Fuel pressure rises to approx. 3.5 bar.

Max. charge-air pressure between 0.45 and 0.53 bar.

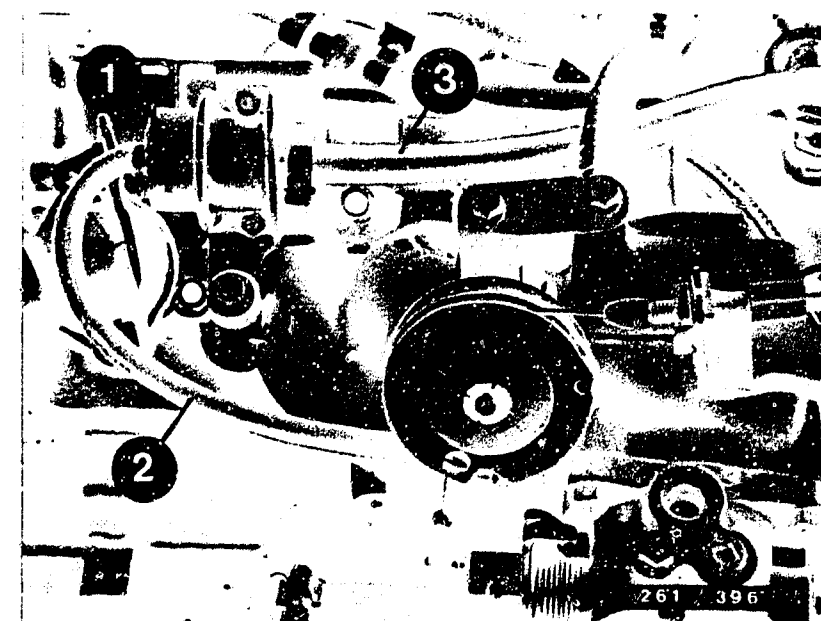
Trouble-shooting:

- Fuel filter clogged → replace.
- Voltage at fuel pump plugs, with engine running, min. 12 V. If not, clean contacts; possibly eliminate poor ground connection, replace leads.

Yes

Continued on L1/L2

Continued on K23/K24



1 = Pressure regulator

2 = Vacuum hose

3 = Fuel return line

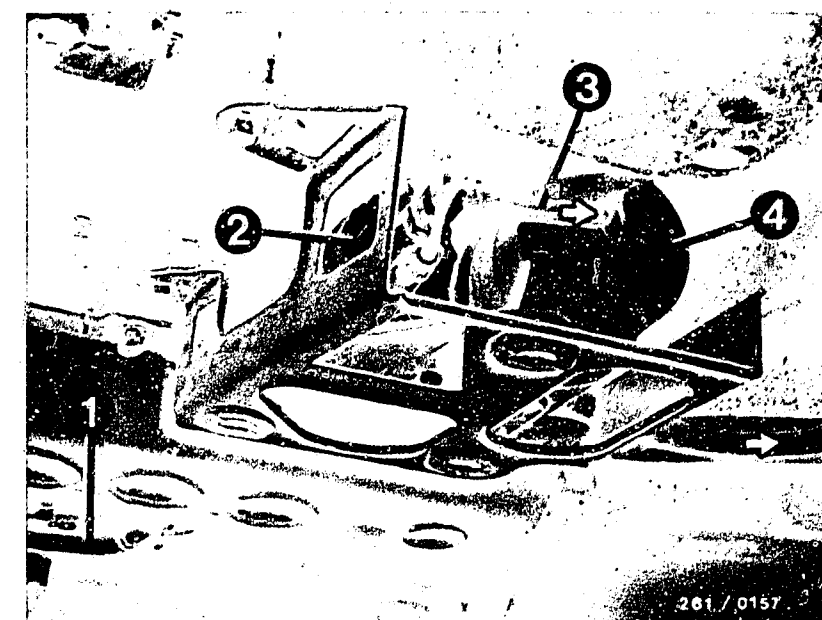
1 = Fuel intake line

2 = Electric fuel pump

3 = Fuel delivery line

4 = Fuel filter

Arrows = Direction of flow



**K21**

No maximum engine power

Volvo 740/760 Turbo



**K22**

No maximum engine power

Volvo 740/760 Turbo



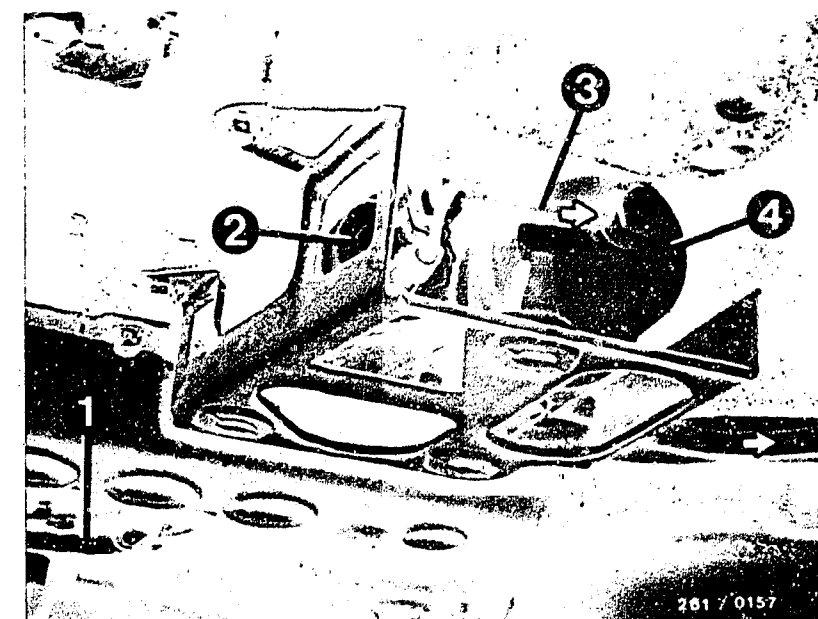
No maximum engine power / top speed cannot be reached (continued)

Trouble-shooting (continued)

- Check pre-supply pump  
Listen: Loosen one electrical connection on electric fuel pump. Switch on fuel pump. On test adapter program switch "V" at position 17. Switch on ignition and press button T3. Pre-supply pump must operate. If not, check connecting leads and if necessary replace pre-supply pump.
- Fuel pressure regulator defective → replace.
- Fuel pump delivery too low → replace fuel pump.
- Strainer or pre-supply pump in tank clogged?  
Corrosion in tank?
- Charge-air pressure too low:  
Air-carrying parts leaking, bypass air valve leaking, wastegate not closing, shaft in turbo-charger broken.
- Charge-air pressure too high:  
Control line clogged, control line leaking, diaphragm of wastegate broken and wastegate sticking (not opening).  
Control-pressure line defective or incorrectly energized.

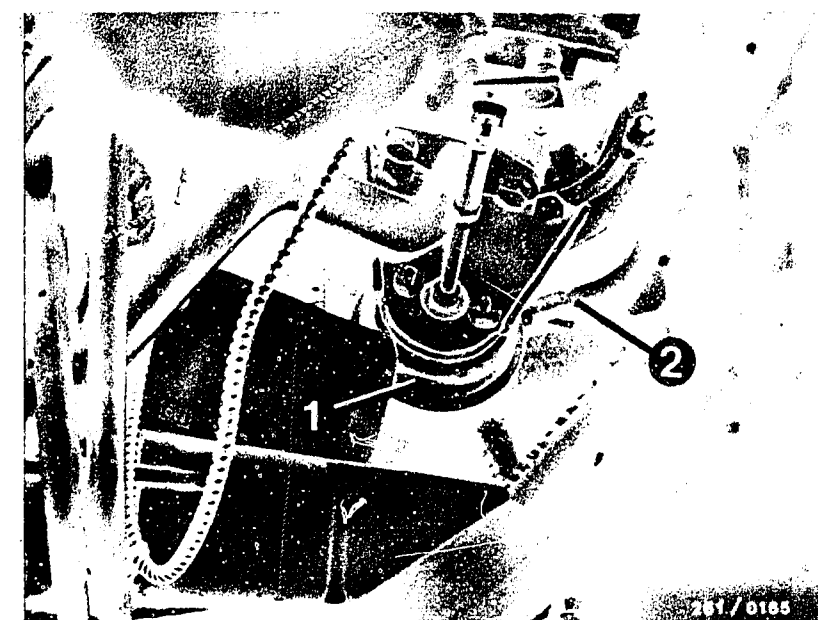
Yes

Continued on L1/L2



1 = Fuel intake line  
2 = Electric fuel pump  
3 = Fuel delivery line  
4 = Fuel filter  
Arrows = Direction of flow

1 = Wastegate  
2 = Control line



**K23**

No maximum engine power  
Volvo 740/760 Turbo



**K24**

No maximum engine power  
Volvo 740/760 Turbo



No maximum engine power / top speed cannot be reached (continued)

yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

yes

Testing completed for customer complaint

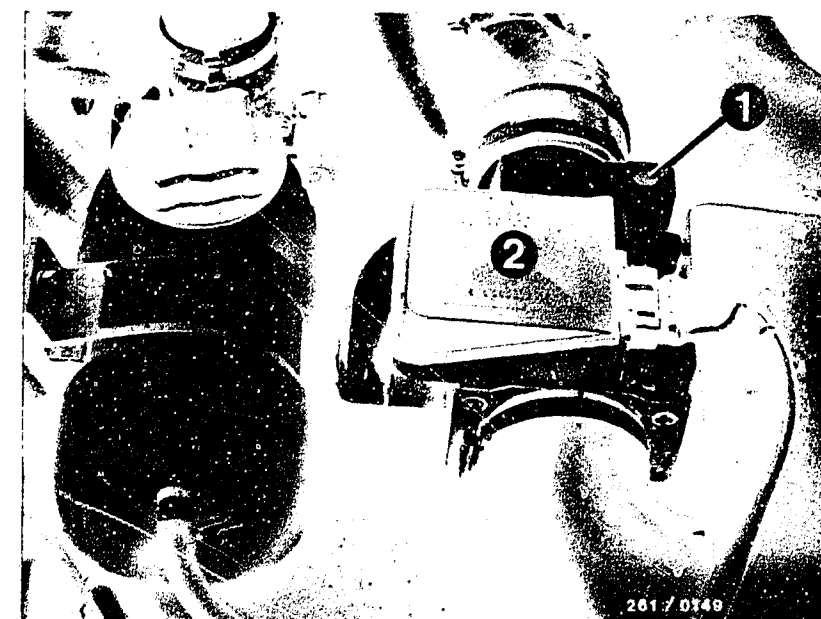
"No maximum engine power".

Customer complaint remedied?

no

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinate C3/C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor

Arrow = Idle actuator



L1

No maximum engine power  
Volvo 740/760 Turbo



L2

No maximum engine power  
Volvo 740/760 Turbo



## CO ADJUSTMENT AT IDLE TOO LOW OR TOO HIGH

Trouble-shooting program according to customer complaint

How to use the following trouble-shooting program

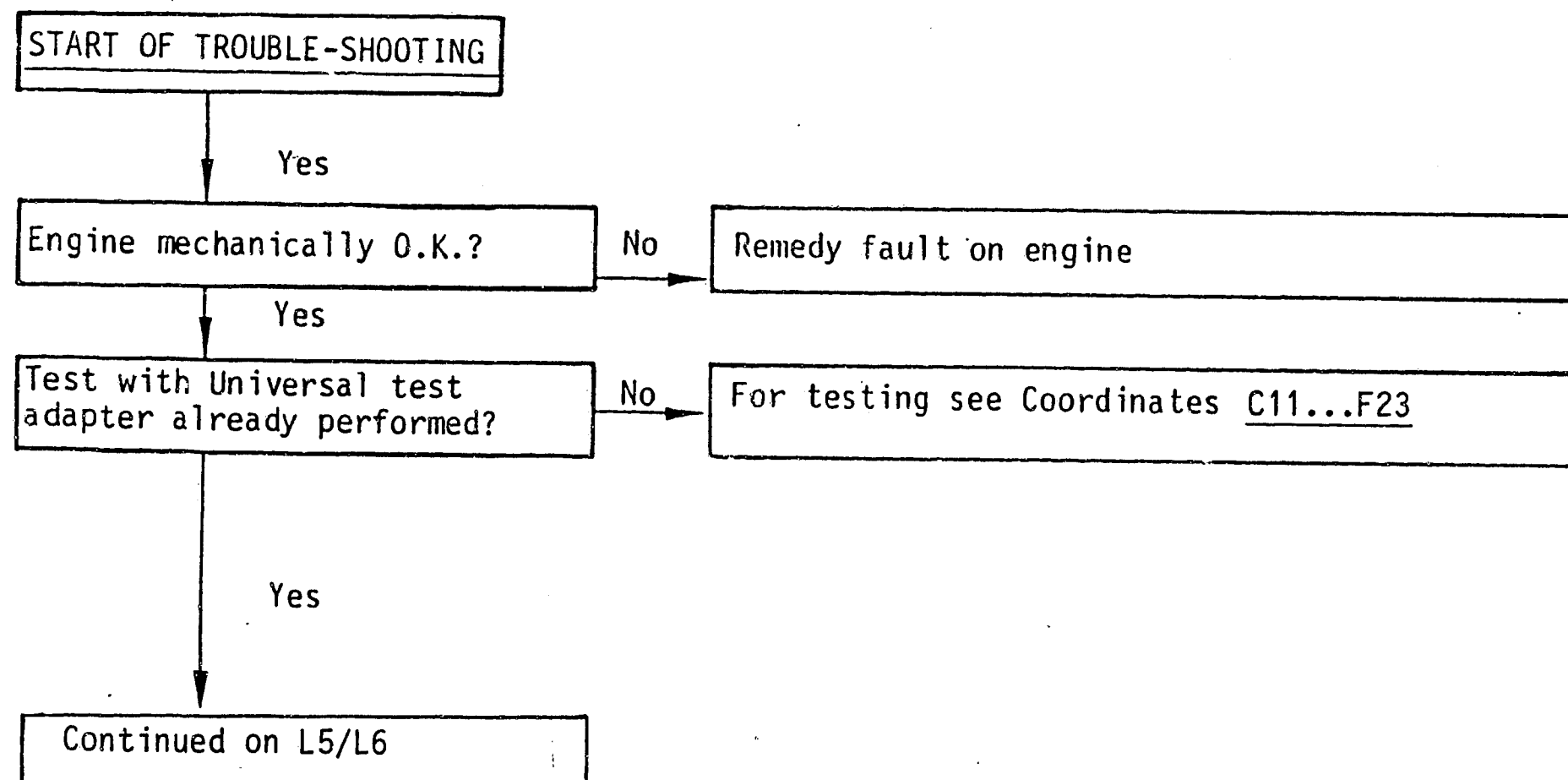
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**L3**

CO adjustment

Volvo 740/760 Turbo



**L4**

CO adjustment

Volvo 740/760 Turbo



CO adjustment at idle too low or too high (continued)

Yes

Check secondary pattern of all cylinders at cranking speed. Secondary pattern O.K.?

No

Check ignition coil and high-voltage distributor. Check distributor cap for dirt and arcing damage. Make sure that the plastic part is installed in the mounting slot of the high-voltage distributor. With this plastic part the high-voltage distributor is correctly adjusted. Note the cylinder numbers when connecting the H.T. cables. Do not forget screening cover. Check ignition coil primary for continuity (approx.  $0\ \Omega$ ). Secondary resistance: 5 to 7.2 k $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:	1 k $\Omega$
Distributor outer dome:	1 k $\Omega$
Distributor center dome:	0 k $\Omega$
Spark-plug connector:	5 k $\Omega$
Ignition coil:	0 k $\Omega$

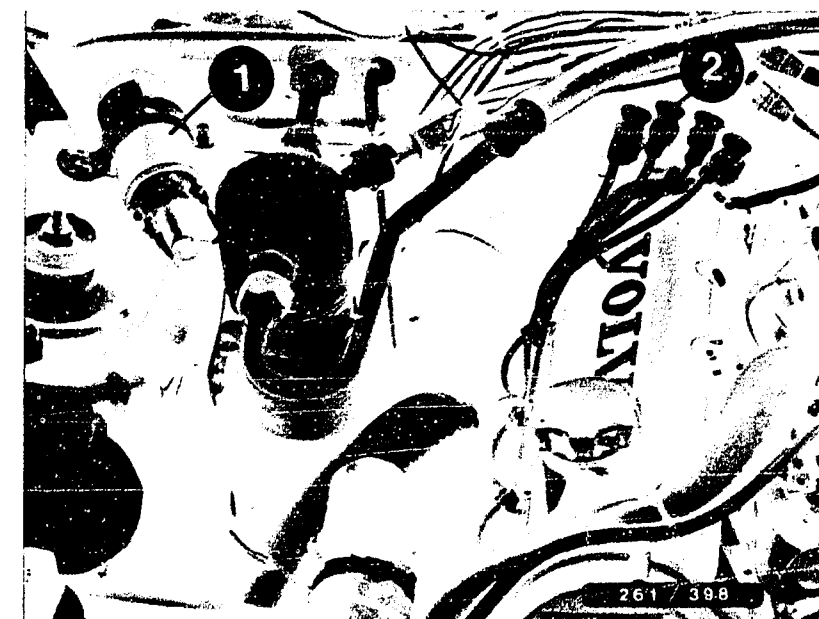
Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Continued on L7/L8



- 1 = Ignition coil
- 2 = High-voltage distributor

**L5**

CO adjustment

Volvo 740/760 Turbo



**L6**

CO adjustment

Volvo 740/760 Turbo



CO adjustment at idle too low or too high (continued)

Yes

Start valve O.K.?  
(Leak test)

No

Testing the start valve for leaks:

1. When installed

Switch over directional-control valve of pressure tester so that start valve is shut off from fuel-distribution pipe. If engine now starts, replace start valve.

2. When removed

Remove start valve (Caution! Fire hazard!)

Fuel line and electric lead remain connected (place collector vessel under the start valve).

Build up fuel pressure:

On the universal test adapter set the program switch "V" to position 17. Switch on the ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on L9/L10



Arrow = Start valve  
(at bottom on intake  
manifold)

L7

CO adjustment  
Volvo 740/760 Turbo



L8

CO adjustment  
Volvo 740/760 Turbo



CO adjustment at idle too low or too high (continued)

yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

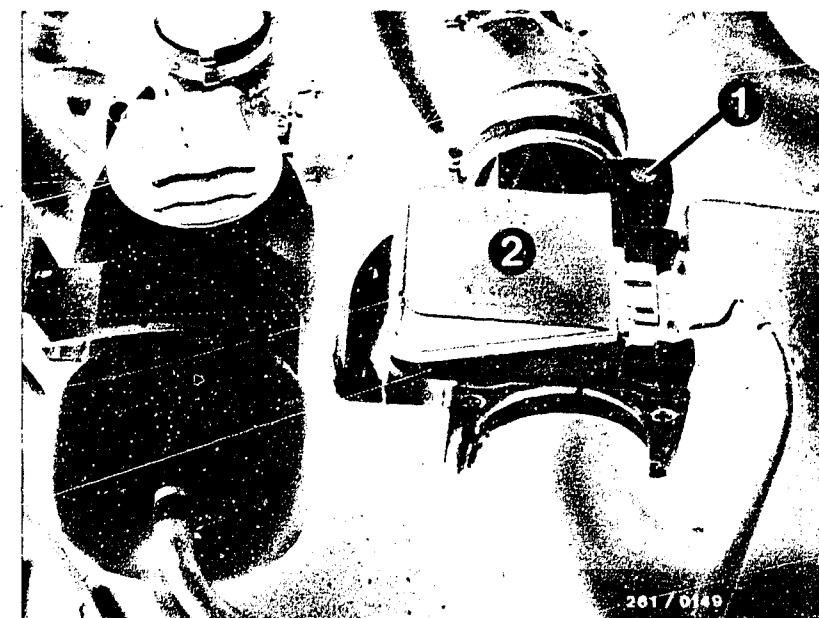
Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Leak test:

Seal off exhaust tail pipe. Unscrew air-filter top part from air-flow sensor and seal off air-flow sensor duct. Disconnect hose after idle actuator and blow air (approx. 0.3 bar gauge pressure) into intake manifold with compressed-air gun. Seal off idle actuator connection port. Open throttle valve fully when doing this. Using leak-detector spray or soapy water, brush or spray all joints. Bubbling or foaming indicates a leak. Check electrical contacts for loose contacts.

yes

Continued on L11/L12



1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I

Arrow = Idle actuator



**L9**

CO adjustment

Volvo 740/760 Turbo



**L10**

CO adjustment

Volvo 740/760 Turbo



CO adjustment at idle too low or too high (continued)

Yes

Exhaust-gas test with CO analyzer with engine at normal operating temperature

Checking value:

0.5 ... 2.0 % by vol. CO

Setting value:

1.0% by vol. CO

No

Requirement: Idle speed 900 min<sup>-1</sup> and all electrical devices off. Remove plastic plug in air-flow sensor.

• CO concentration too low:

Turn bypass screw in air-flow sensor gradually in a clockwise direction (turning to the right).

• CO concentration too high:

Turn bypass screw in air-flow sensor gradually in a counterclockwise direction (turning to the left).

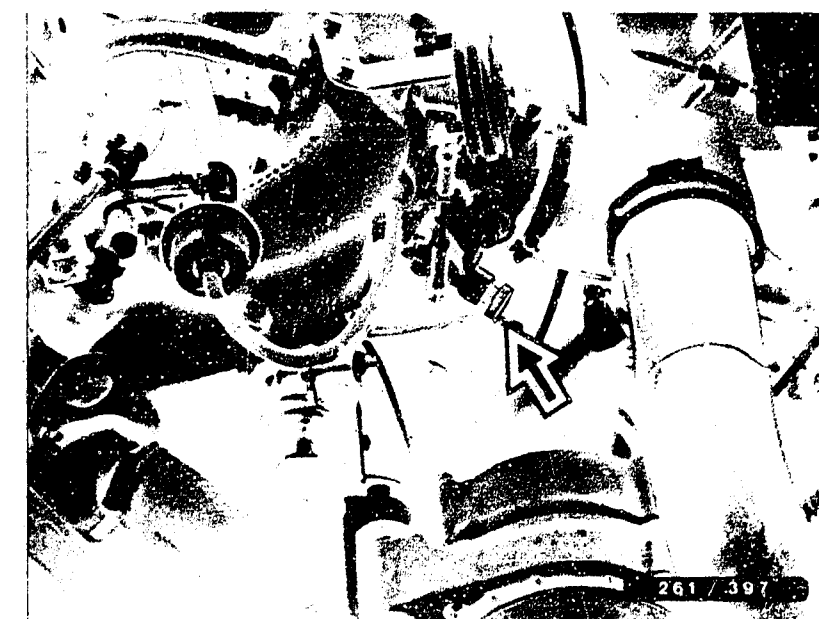
If CO not adjustable:

- CO concentration too low: repeat leak test on intake system.
- CO concentration too high: check air-flow sensor; repeat measurement with crankcase ventilation hose disconnected (gasoline in oil?).

Note: After CO adjustment, insert new plug (red) in air-flow sensor.

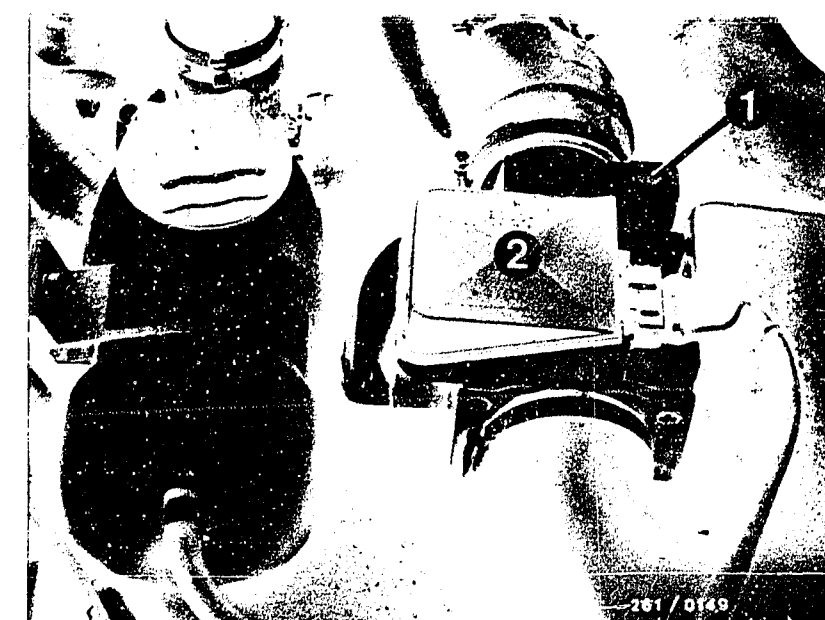
Yes

Continued on L13/L14



Arrow = Idle-speed-adjustment screw.

1 = Idle-mixture-adjusting screw  
2 = Air-flow sensor with NTC I



**L11**

CO adjustment

Volvo 740/760 Turbo



**L12**

CO adjustment

Volvo 740/760 Turbo





CO adjustment at idle too low or too high (continued)

Yes

Testing completed for  
customer complaint

"CO adjustment at idle  
too low or too high"

Customer complaint  
remedied?

No

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates C3...C10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates C3/C4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**L13**

CO adjustment

Volvo 740/760 Turbo



**L14**

CO adjustment

Volvo 740/760 Turbo



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

13...39

VDT-I-261/102 En

6.1983

PARTS SET FOR SOLENOID-OPERATED INJECTION VALVES

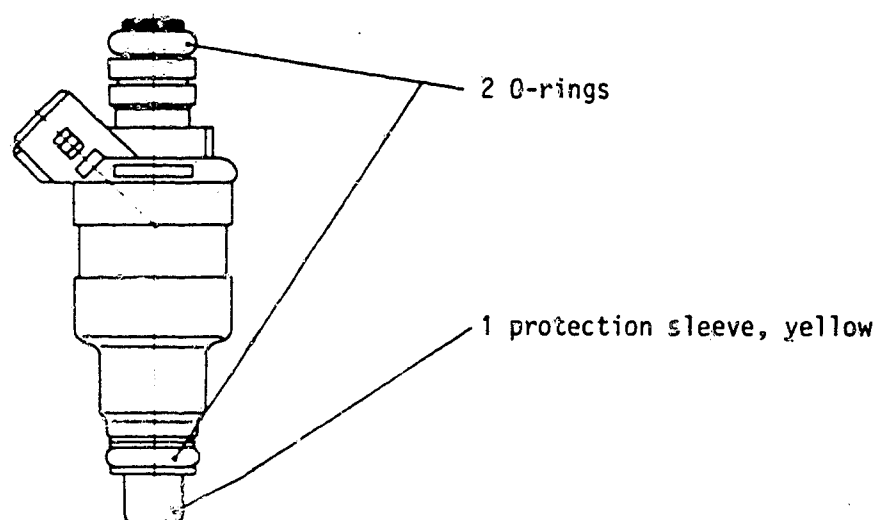
Supersedes 8.1982 edition

0 280 150 2..

AND PRESSURE REGULATORS 0 280 160 2..

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve:



Contents for pressure regulator:

1 O-ring

1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

**BOSCH**

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**N1**

Technical Bulletin

Volvo 740/760 Turbo



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